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HEAVY MACHINE OPERATOR

CBT CURRICULUM

National Vocational Certificate Level 4

Version 1 - November, 2019

NAVTTC

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1. Introduction

In order to build the capacity of technical and vocational training institutes in Pakistan through provision of demand driven competency based trainings in construction sector the NAVTTC, and TEVT Sector Support Program (TSSP) have joined hands together to develop qualifications for construction sector. These qualifications will not only build the capacity of existing workers of this sector but also support the youth to acquire skills best fit for this sector. The benefits and impact of development of these qualifications will be on both demand and supply side.

Based upon this demand of industry these competency-based qualifications for Heavy Machine Operator are developed under National Vocational Qualification Framework (NVQF) (Level 1 to 4). The qualifications mainly cover competencies along with related knowledge and professional skills which are essential for getting a job or self-employed.

The qualifications are also in line with the vision of Pakistan's National Skills Strategy (NSS), National TVET Policy and NVQF. This provides policy directions, support and an enabling environment to the public and private sectors to impart training for skills development to enhance social and economic profile. NAVTTC has approved the nomination of a Qualification Development Committee (QDC). The QDC consists of experts from the relevant industries from different geographical locations across Pakistan and academicians who were consulted during the development process to ensure input and ownership of all the stakeholders. The National Competency Standards could be used as a referral document for the development of curricula to be used by training institutions.

1.1 Purpose of the training program:

The purpose of the training is to produce skilled manpower for improving the existing capacity of the construction sector. This training will equip trainees with the required skills to operate Heavy Machines. It will enable the participants to meet the challenges in the field of construction industry. Further, to improve the skill level of the Operators and prepare them for the construction industry to meet the market competition nationally and internationally. The core purpose of this qualification is to produce employable Heavy Machine Operators who could operate Heavy Machines according to national and international standards. In addition, this qualification will prepare the youth to find employment in the construction sector.

1.2 Overall objectives of training program:

The Heavy Machine Operator qualification level 1-4 consists of theoretical and practical details required to learn operational techniques of Bulldozer, Wheel Loader, Excavator and Grader machines.

1.3 Competencies to be gained after completion of course:

The detail of the competency standards included in this qualification are given below:

National Vocational Certificate level 4, in (Construction Sector) "Heavy Machine Operator"

1. Contribute to Work Related Health and Safety (WHS) Initiatives
2. Analyze Workplace Policy and Procedures
3. Perform Advanced Communication
4. Develop Advance Computer Application Skills
5. Manage Human Resource Services
6. Develop Entrepreneurial Skills
7. Operate Excavator
8. Operate Grader
9. Plan Work

1.4 Job opportunities:

Heavy Machine Operators (HMO) are in demand across the country and abroad. Their services are required for everything from road and bridge construction, bulldozing, loading and grading, to excavating and much, much more. This is a good career opportunity for a reliable and responsible individual with a strong work ethic. Heavy Machine Operators not only work on regular construction building jobs, but also on infrastructure projects (roads, bridges, canals, dams, railway lines and ports, otherwise called non-building construction), and in mining and timber operations.

1.5 Entry level of trainees:

The entry level for National Vocational Certificate level 4, "Heavy Machine Operator" in (Construction Sector) are given below:

Title	Entry requirements
National Vocational Certificate level 4, in "Heavy Machine Operator" (Construction Sector)	Entry for assessment for this qualification is open. However, entry into formal training institute for this qualification is person having National Vocational Certificate level 3, in (Construction Sector) "Heavy Machine Operator" or GIII or middle with 1 year work experience.

1.6 Minimum qualification for teachers:

- Should have completed intermediate and equivalent qualifications.
- Must be a holder of G I certificate in relevant field or DAE in Civil Technology.
- Must be able to communicate effectively both orally and in written form.
- Must have at least two 2 years teaching experience.

1.7. Recommended trainer/trainee ratio

Generally, Trainer/Trainee ratio for CBT courses is 1:20

1.8 Medium of instruction:

English, Urdu, local language.

1.9 Duration of the course:

The proposed curriculum is composed of **09** modules that will be covered in **710** learning hours. It is proposed that the course may be delivered in **Six Months** period.

The distribution of contact hours is given below:

Total - 710 hours.

Theory - 142 hours (20%)

Practical - 568 hours (80%)

1.10 Sequence of the modules

Following is the structure of the course:

NVQF Level	Module #	Title	Category	Theory (hours)	Practical (hours)	Total (hour)	Credits hours	Total Credit Hours
4	A	Contribute to Work Related Health and Safety (WHS) Initiatives	Generic	06	24	30	03	71
	B	Analyze Workplace Policy and Procedures	Generic	06	24	30	03	
	C	Perform Advanced Communication	Generic	06	24	30	03	
	D	Develop Advance Computer Application Skills	Generic	08	32	40	04	
	E	Manage Human Resource Services	Generic	04	16	20	02	
	F	Develop Entrepreneurial Skills	Generic	06	24	30	03	
	G	Operate Excavator	Technical	50	200	250	25	
	H	Operate Grader	Technical	40	160	200	20	
	I	Plan Work	Technical	16	64	80	8	
TOTAL				142	568	710	71	
Percentage.				20%	80%			

2. Overview of the Curriculum for Heavy Machine Operator:

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of Modules
Module A: **Contribute to Work Related Health and Safety (WHS) Initiatives** **Aim:** This unit describes the skills and knowledge required to manage the identification, review, development, implementation and evaluation of effective participation and consultation processes as an integral part of managing work health and safety (WHS).	**LU1.** Contribute to initiate work-related health and safety measures **LU2.** Contribute to establish work-related health and safety measures **LU3.** Contribute to ensure legal requirements of WHS measures **LU4.** Contribute to review WHS measures **LU5.** Evaluate the organization's WHS system	**06**	**24**	**30**
Module B: **Comply with Workplace Policy and Procedures** **Aim:** This unit describes the skills and knowledge required to implement a workplace policy & procedures and to modify the policy to suit changed circumstances. It applies to individuals with managerial responsibilities who undertake work developing approaches to create, monitor and improve strategies and policies within workplaces and engage with a range of relevant stakeholders and specialists.	**LU1.** Manage work timeframes **LU2.** Manage to convene meeting **LU3.** Decision making at workplace **LU4.** Set and meet own work priorities at instant **LU5.** Develop and maintain professional competence **LU6.** Follow and implement work safety requirements	**06**	**24**	**30**

Module C: **Perform Advanced Communication** **Aim:** This unit describes the performance outcomes, skills and knowledge required to develop communication skills used professionally. It covers plan and organise work and conduct trainings at workplace, along with demonstrating professional skills independently	**LU1.** Demonstrate professional skills **LU2.** Plan and Organize work **LU3.** Provide trainings at workplace	**06**	**24**	**30**
Module D: **Develop Advance Computer Application Skills** **Aim:** This unit provides an overview of Microsoft Office programs to create personal, academic and business documents following current professional and/or industry standards, i.e. Data Entry, Power Point Presentation and managing data base and graphics for Design. It applies to individuals employed in a range of work environments who need to be able to present a set range of data in a simple and direct forms	**LU1.** Manage Information System to complete a task **LU2.** Prepare Presentation using computers **LU3.** Use Microsoft Access to manage database **LU4.** Develop graphics for Design	**08**	**32**	**40**

Module E: **Manage Human Resource Services** **Aim:** This unit describes the skills and knowledge required to plan, manage and evaluate delivery of human resource services, integrating business ethics. It applies to individuals with responsibility for coordinating a range of human resource services across an organization. They may have staff reporting to them.	**LU1.** Determine strategies for delivery of human resource services **LU2.** Manage the delivery of human resource services **LU3.** Evaluate human resource service delivery **LU4.** Manage integration of business ethics in human resource practices	**04**	**16**	**20**
Module F: Develop Entrepreneurial Skills **Aim:** This Competency Standard identifies the competencies required to develop entrepreneurial skills, in accordance with the organization's approved guidelines and procedures. You will be expected to develop a business plan, collect information regarding funding sources, develop a marketing plan and develop basic business communication skills. Your underpinning knowledge regarding entrepreneurial skills will be sufficient to provide you the basis for your work.	**LU1.** Develop a business plan **LU2.** Collect information regarding funding sources **LU3.** Develop a marketing plan **LU4.** Develop basic business communication skills	**06**	**24**	**30**

Module G: **Operate Excavator** **Aim:** This module covers the skills and knowledge required to Comply with safety requirements, Sets up equipment, Install attachments, Operate controls of Wheel Excavator, Operate controls of Crawler Excavator, Create slopes, Build, excavate, and maintain haul roads and ramps, Create mass excavation, Excavate trenches, Excavate ditches, Load trucks, Cut and fills materials, Stock piles materials, Excavate and back fills trenches, Hoist objects, Clear land, Demolish buildings and other structures and Monitor performance of machines.	**LU-1:** Safety requirements **LU-2:** Sets up equipment **LU-3:** Install attachments **LU-4:** Operate controls of Wheel Excavator **LU-5:** Operate controls of Crawler Excavator **LU-6:** Create slopes **LU-7:** Build, excavate, and maintain haul roads and ramps **LU-8:** Create mass excavation. **LU-9:** Excavate trenches **LU-10:** Excavate ditches **LU-11:** Load trucks **LU-12:** Cut and fills materials **LU-13:** Stock piles materials **LU-14:** Excavate and back fills trenches **LU-15:** Hoist objects **LU-16:** Clear land **LU-17:** Demolish buildings and other structures **LU-18:** Performance of machines	**50**	**200**	**250**
Module H: **Operate Grader** **Aim:** This module covers the skills and knowledge required to Operate Controls, Apply grading fundamentals, Form and handle windrows, Strip surface materials, Cut and fill material, Maintain access roads, Create slopes, Create ditches, Create shouldering, Form sub-grade, Place aggregates to specified elevations (finish grading) and Clear snow and ice.	**LU-1:** Operate controls **LU-2: G**rading fundamentals **LU-3:** Form and handle windrows **LU-4:** Strip surface materials **LU-5:** Cut and fill material **LU-6:** Maintain access roads **LU-7:** Create slopes **LU-8:** Create ditches **LU-9:** Create shouldering **LU-10:** Form sub-Grade **LU-11:** Finish grading	**40**	**160**	**200**

	LU-12: Clear snow and ice			
Module I: **Plan Work** **Aim:** This module covers the skills and knowledge required to Assess site hazards, Ensure work procedures, Follow symbols and markings, Follow survey markers, construction grades, and stakes, Monitor drawings and plans, Develop environmental concerns with site personnel, Demonstrate grades and stakes, Demonstrate grade checking devices, Review job specifications and safety considerations with site personnel.	**LU-1:** Site hazards **LU-2:** Work procedures **LU-3:** Symbols and markings **LU-4:** Survey markers, construction grades, and stakes **LU-5:** Drawings and plans **LU-6:** Environmental concerns with site personnel **LU-7:** Grades and stakes **LU-8:** Grade checking devices **LU-9:** Review job specifications and safety considerations with site personnel	**16**	**64**	**80**
	TOTAL	**142**	**568**	**710**

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Module-G

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3. Heavy Machine Operator:

Module G: Operate Excavator

Objective: This module covers the skills and knowledge required to Comply with safety requirements, Sets up equipment, Install attachments, Operate controls of Wheel Excavator, Operate controls of Crawler Excavator, Create slopes, Build, excavate, and maintain haul roads and ramps, Create mass excavation, Excavate trenches, Excavate ditches, Load trucks, Cut and fills materials, Stock piles materials, Excavate and back fills trenches, Hoist objects, Clear land, Demolish buildings and other structures and Monitor performance of machines.

Duration: 250 Hours **Theory: 50 Hours** **Practice: 200 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Safety requirements	• Operate safety controls and equipment • Respond to caution, warning and hazard signs, lights and symbols	• Explain safety equipment. • Describe safety controls and their operations • Describe warning, hazard signs, lights and symbols	Theory- 03 Hrs. Practical- 10 Hrs. Total- 13 Hrs.	• Excavator	Class Room and Workplace
LU2. Sets up equipment	• Adjust to factors affecting safe operation of equipment • Maintain stability of equipment • Position equipment correctly • Communicate with traffic control person	• Describe pre shift routine • Describe positioning of equipment • Explain different signals between operator and controller	Theory- 03 Hrs. Practical- 10 Hrs. Total- 13 Hrs.	• Excavator	Class Room and Workplace

LU3. Install attachments	• Select appropriate tools. • Position equipment and attachment for installation. • Respond to hand signals. • Install attachments safely.	• Describe tools used for installment of attachments • Describe methods of installation of attachments	Theory- 03 Hrs. Practical- 12 Hrs. Total- 15 Hrs.	• Excavator • Attachments	Class Room and Workplace
LU4. Controls of Wheel Excavator	• Operate control smoothly and safely • Operate different operating controls simultaneously as required • React to changing conditions/situations	• Define basic operating functions. • Describe different operating controls and their functions • Describe different situations which an operator can encounter under different conditions • Describe smooth and safe handling of controls	Theory- 04 Hrs. Practical- 12 Hrs. Total- 16 Hrs.	• Wheel Excavator	Class Room and Workplace
LU5. Controls of Crawler Excavator	• Operate control smoothly and safely • Operate different operating controls simultaneously as required. • React to changing conditions/situations	• Define basic operating functions • Describe different operating controls and their functions • Describe different situations which an operator can encounter under different conditions • Describe smooth and safe handling of controls	Theory- 03 Hrs. Practical- 12 Hrs. Total- 15 Hrs.	• Crawler Excavator	Class Room and Workplace

LU6. Create slopes	• Interpret specifications of slope • Practice grade checking instruments • Fill cuts in the slope with a partial bucket technique	• Describe stakes/specifications • Describe grade checking instruments • Describe methods of making slope in different conditions • Describe safety measures to be kept in consideration while working on slopes • Describe problems faced while making slope	Theory- 03 Hrs. Practical- 10 Hrs. Total- 13 Hrs.	• Excavator	Class Room and Workplace
LU7. Build, excavate, and maintain haul roads and ramps	• Work around obstructions and hazards. • Practice grade checking devices. • Protect existing structures and utilities • Build, excavate or maintain haul roads and ramps in accordance with job specifications	• Define capacities & capabilities of Machine. • Describe nature of strata/soil • Describe method for estimation of excavation • Describe grade checking instruments • Explain utilities and their protection	Theory- 02 Hrs. Practical- 16 Hrs. Total- 18 Hrs.	• Excavator	Class Room and Workplace
LU8. Create mass excavation	• Adopt laser location for line of sight as excavation progresses.	• Describe types of soils and their characteristics	Theory- 03 Hrs. Practical- 12 Hrs.	• Excavator	Class Room and Workplace

	• Perform straight edges and stable sides • Dig offset from footing location • Keep the machine level • Level to very fine tolerance • Adopt partial bucket technique.	• Describe attachments to be used for different types of soil • Describe techniques of excavation • Describe methods to keep the machine level • Describe precautions in mass excavation	Total- 15 Hrs.		
LU9. Excavate trenches	• Work around site obstructions and hazards • Maintain equipment in stable position and correct location for job • Practice grade checking devices. • Excavate trench in accordance with job specifications • Respond to hand signals	• Describe special attachments to be used for making trenches • Describe problems faced while making trenches • Describe trenches to be made under different environment/conditions • Describe safety measures to be kept in mind while making trenches	Theory- 03 Hrs. Practical- 12 Hrs. Total- 15 Hrs.	• Excavator along with special attachments	Class Room and Workplace
LU10. Excavate ditches	• Work around site obstructions and hazards. • Maintain equipment in stable position and correct location for job	• Describe special attachments to be used for making ditch • Describe problems faced while making ditch	Theory- 03 Hrs. Practical- 12 Hrs. Total- 15 Hrs.	• Excavator • Different Grade checking devices	Class Room and Workplace

	• Practice grade checking devices • Excavate ditches in accordance with job specifications • Respond to hand signals	• Describe ditches to be made under different environment/conditions • Describe safety measures to be kept in mind while making ditch • Describe hand signals and response			
LU11. Load trucks	• Work around obstructions and hazards • Direct loading vehicle operators. • Align according to the position of truck • Load transport vehicles in accordance with job specifications • Respond to hand signals	• Describe Loading techniques • Describe expected hazards • Describe how to avoid hazards while loading • Describe important signals followed while loading	Theory- 03 Hrs. Practical- 12 Hrs. Total- 15 Hrs.	• Excavator • Dump Truck	Class Room and Workplace
LU12. Cut and fills materials	• Work around site obstructions and hazards • Position equipment correctly • Practice grade checking devices	• Define capacities & capabilities of Machine. • Describe method for estimation of cuts and fill • Describe grade checking instruments	Theory- 03 Hrs. Practical- 12 Hrs. Total- 15 Hrs.	• Excavator • Different Grade checking devices	Class Room and Workplace

	• Cut and fill material in accordance with job specifications • Tamp the filled material • Respond to hand signals	• Describe techniques how to cut humps and fill depressions • Describe how to tamp the filled material			
LU13. Stock piles materials	• Work around site obstructions and hazards • Stockpile material in accordance with jobs specifications	• Describe how to stock pile material in accordance with jobs specifications • Describe how to work around site obstructions and hazards	Theory- 02 Hrs. Practical- 10 Hrs. Total- 12 Hrs.	• Excavator	Class Room and Workplace
LU14. Excavate and back fill trenches	• Work around site obstructions and hazards • Ensure that structures or utility lines are not damaged during backfilling • Maintain stability of equipment • Level or layer the material • Practice grade checking devices. • Backfill trenches/excavations in accordance with job	• Describe the techniques/methods of back filling • Describe safety precautions while backfilling	Theory- 02 Hrs. Practical- 12 Hrs. Total- 14 Hrs.	• Excavator	Class Room and Workplace

	specifications. • Respond to hand signals.				
LU15. Hoist objects	• Inspect rigging (ropes) components visually • Identify and discard worn or damaged rigging components • Communicate with appropriate personnel to replace worn or damaged components • Work around obstructions and hazards • Set up equipment in stable position and correct location for jobs • Hoist materials in accordance with manufacturer's specifications, job specifications and legislation • Respond to hand signals	• Describe rigging components • Describe checking of damaged rigging components • Describe tools to be used for replacement of damaged rigging components • Describe hoist materials in accordance with manufacturer's specifications, job specifications and legislation	Theory- 03 Hrs. Practical- 08 Hrs. Total- 11 Hrs.	• Excavator • Ropes	Class Room and Workplace
LU16. Clear land	• Work around obstructions and hazards	• Describe types of obstructions and hazards	Theory- 02 Hrs. Practical- 10 Hrs.	• Excavator with necessary attachments	Class Room and Workplace

	• Install attachments. • Maintain haul roads as required • Clear land in accordance with job specifications	• Describe how to work around obstructions and hazards • Describe precautions to be ensured while working around obstructions and hazards • Describe attachments for land clearing as per job specification	Total- 12 Hrs.		
LU17. Demolish buildings and other structures	• Work around obstructions and hazards • Position equipment safely while demolition and always have means of exit • Demolish structures and remove demolished materials in accordance with job specifications • Respond to hand signals	• Describe attachments required for demolition of buildings and other structures • Describe safety precautions during demolition of buildings and other structures • Describe safe entrance into and exits from the site • Describe procedure of removal of demolished materials	Theory- 03 Hrs. Practical- 12 Hrs. Total- 15 Hrs.	• Excavator	Class Room and Workplace
LU18. Performance of machines	• Interpret information from gauges and symbols • Monitor performance using own senses • Identify equipment problems	• Describe information given on different gauges • Explain how to monitor performance of machine • Describe likely problems/down time to be encountered about the machine	Theory- 02 Hrs. Practical- 06 Hrs. Total- 08 Hrs.	• Excavator	Class Room and Workshop

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Module-H

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Module H: Operate Grader

Objective: This module covers the skills and knowledge required to Operate Controls, Apply grading fundamentals, Form and handle windrows, Strip surface materials, Cut and fill material, Maintain access roads, Create slopes, Create ditches, Create shouldering, Form sub-grade, Place aggregates to specified elevations (finish grading) and Clear snow and ice.

Duration: 200 Hours **Theory: 40 Hours** **Practice: 160 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Grader Controls	• Operate controls smoothly and safely • Operate different operating controls simultaneously as required • React to changing conditions/situations	• Describe basic operating functions • Describe different operating controls and their functions • Describe different situations which an operator can encounter under different conditions • Describe smooth and safe handling of controls	Theory- 04 Hrs. Practical- 20 Hrs. Total- 24 Hrs.	• Grader	Class Room and Workshop
LU2. Grading Fundamentals	• Apply wheel lean control • Apply frame articulation fundamentals • Select gear and engine speed • Apply grading tips	• Describe wheel lean control • Describe how to apply frame articulation fundamentals • Explain selection of gear and	Theory- 04 Hrs. Practical- 20 Hrs. Total- 24 Hrs.	• Grader	Class Room and Workshop

		engine speed • Describe grading points			
LU3. Form and handle windrows	• Choose gear and engine speed • Choose blade position • Cut material to form a windrow • Move material back over area	• Describe positions of blade for different tasks • Describe how to form a windrow and how to move material back	Theory- 03 Hrs. Practical- 14 Hrs. Total- 17 Hrs.	• Grader	Class Room and Workplace
LU4. Strip surface materials	• Distinguish waste layer from structural layer • Strip waste materials (usually organic) • Finish windrows of stripped material • Enter and exit machine	• Describe how to strip surface materials • Describe different layers of structures and how to distinguish between them	Theory- 03 Hrs. Practical- 12 Hrs. Total- 15 Hrs.	• Grader	Class Room and Workplace
LU5. Cut and fill material	• Estimate the height of cut and fill • Choose blade tilt, angel and position • Cut heights • Match blade load to available power and traction • Move material to low areas • Grade area to desired profile	• Explain how to cut and fill material • Explain how to grade the surface • Describe tilting of blade • Explain how to Match blade load to available power and traction	Theory- 03 Hrs. Practical- 12 Hrs. Total- 15 Hrs.	• Grader	Class Room and Workshop

LU6. Maintain access roads	• Identify drainage structures, culverts and obstacles • Adjust windrow to allow traffic to continue • Choose blade position, wheel lean, articulation, gear and speed • Reshape and recover materials for the road surface • Cut shoulders and move material to center or from one side to another	• Describe drainage structures, culverts and obstacles • Explain how to reshape and recover materials for the road surface • Explain how to Cut shoulders and move material to center or from one side to another	Theory- 04 Hrs. Practical- 14 Hrs. Total- 18 Hrs.	• Grader	Class Room and Workshop
LU7. Create slopes	• Identify required slope • Apply grade checking instruments • Choose blade position, wheel lean, articulation, gear and speed • Smooth the area at the base of the slope for smooth working platform • Start at the top of slope • Shape the shoulder accurately	• Describe requirement and establishment of gradient and camber • Describe grade checking instruments • Explain how to smooth the area at the base of the slope • Explain layer by layer grading	Theory- 03 Hrs. Practical- 10 Hrs. Total- 13 Hrs.	• Grader	Class Room and Workshop
LU8. Create ditches	• Identify the required profile using grade checking instruments • Choose blade position, wheel lean,	• Describe ditches to be made under different environment/conditions	Theory- 03 Hrs. Practical- 10 Hrs. Total- 13 Hrs.	• Grader	Class Room and Workshop

	articulation, gear and speed • Shape ditch by repeated passes.	• Describe safety measures to be kept in mind while making ditch • Describe problems faced while making ditch			
LU9. Create shouldering	• Choose blade position, wheel lean, articulation, gear and speed • Position grader with outer tires on pavement, and inner tires just off pavement on shoulder for left side shoulder • Position grader with inner tires on pavement, and outer tires just off pavement on shoulder for right side shoulder • Move only enough material to pavement edge to dress the shoulder • Roll the windrow back away from the pavement edge • Shape the shoulder accurately	• Describe shouldering and positioning of blade for this task • Explain how to dress the shoulders	Theory- 03 Hrs. Practical- 14 Hrs. Total- 17 Hrs.	• Grader	Class Room and Workshop

LU10. Sub-grading	• Choose blade tilt, angel and position • Match blade load to available power and traction • Remove unsuitable material • Cut and fill load bearing soils to create desired profile • Shape for drainage and ditch as required	• Describe sub grade • Describe method of removal of unsuitable material • Explain the blade position for sub grading	Theory- 03 Hrs. Practical- 10 Hrs. Total- 13 Hrs.	• Grader	
LU11. Finish grading	• Identify the required profile using grade checking instruments • Get the correct volume in the efficient placement • Position for efficient spreading • Get correct volume of aggregates • Shift the circle and blade towards the piles • Cut out windrows only as large as the machine can handle without tire spinning • Angle the blade as appropriate • Precise control to achieve elevations and shape to very accurate tolerances	• Describe how to accurately perform grading of aggregates • Describe identification of profile using grade checking instruments • Explain positioning of machine for efficient spreading • Explain how to avoid wastage of aggregates	Theory- 03 Hrs. Practical- 10 Hrs. Total- 13 Hrs.	• Grader	Class Room and Workshop

LU12. Clear snow and ice	• Choose proper attachment, as chains, V-plow, wing plow, skid shoes and wing gates • Identify snow type, moisture content, density, weight, depth of snow, underlying surface, weather, visibility, traffic, obstacles and hidden structures • Mount chain on tires carefully • Drive the machine in higher speed to move snow across and off the blade	• Describe snow clearing attachments and working procedure for snow clearance • Describe safety precautions in snow clearance • Describe use of chains on wheels • Describe the procedure for identification of obstacles and hidden structures and their removal	Theory- 04 Hrs. Practical- 14 Hrs. Total- 18 Hrs.	• Grader with necessary attachments	Class Room and Workshop

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Module-I

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Module I: Plan Work

Objective: This module covers the skills and knowledge required to Assess site hazards, Ensure work procedures, Follow symbols and markings, Follow survey markers, construction grades, and stakes, Monitor drawings and plans, Develop environmental concerns with site personnel, Demonstrate grades and stakes, Demonstrate grade checking devices, Review job specifications and safety considerations with site personnel.

Duration: 80 Hours **Theory: 16 Hours** **Practice: 64 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Site hazards	• Inspect site visually • Communicate with site supervisor • Identify actual and potential hazards	• Describe visual inspection of site • Describe methods of communication with site supervisor • Describe how to read and understand the site plan/drawings • Describe potential hazards at site	Theory- 02 Hrs. Practical- 08 Hrs. Total- 10 Hrs.	Nil	Class Room and Workplace
LU2. Work procedures	• Identify equipment and attachments needed to do the job • Determine appropriate starting point • Identify access and exit points on site	• Describe and enlist equipment and attachments to perform the job • Describe the appropriate starting, exit and access points • Describe work procedures for efficiency, effectiveness and safety • Describe work activities and	Theory- 02 Hrs. Practical- 08 Hrs. Total- 10 Hrs.	Nil	Class Room and Workplace

	• Plan work procedures for efficiency, effectiveness and safety • Sequence job tasks to co-ordinate activities with others	estimated completion time			
LU3. Symbols and markings	• Identify survey markers, grade and stakes • Differentiate between survey markers, construction grades and stakes	• Describe the method of survey markers, grade and stakes • Describe the difference between survey markers, construction grades and stakes	Theory- 02 Hrs. Practical- 08 Hrs. Total- 10 Hrs.	Nil	Class Room and workplace
LU4. Survey markers, construction grades, and stakes	• Recognize symbols • Identify markings on job site	• Describe types of survey marker, symbols and their identification	Theory- 02 Hrs. Practical- 08 Hrs. Total- 10 Hrs.	Nil	Class Room and Workplace
LU5. Drawings and plans	• Perform metric and imperial measurements • Interpret abbreviations and symbols common to civil drawings • Distinguish between plan, side view and section • Determine scale and north orientation	• Describe metric and imperial measurements • Describe symbols used in drawings and plans and their interpretation • Describe difference between plan, elevation and cross section • Describe scale and indication of north on the drawing	Theory- 03 Hrs. Practical- 14 Hrs. Total- 17 Hrs.	Nil	Class Room and Workshop

LU6. Environmental concerns with site personnel	• Identify actual and potential environmental concerns, such as proximity to water courses, noise levels, fuel leaks and hazardous materials • Communicate with site supervisor	• Describe environmental concerns, such as proximity to water courses, noise levels, fuel leaks and hazardous materials	Theory- 01 Hrs. Practical- 08 Hrs. Total- 09 Hrs.	Nil	Class Room and Workshop
LU7. Grades and stakes	• Interpret symbols and markings on stakes • Mark stakes/surface with appropriate symbols or markings, such as colored paint and ribbons	• Describe color codes for civil works and their importance	Theory- 01 Hrs. Practical- 04 Hrs. Total- 05 Hrs.	Nil	Class Room and Workshop
LU8. Grade checking devices	• Check grades using information on stakes and site plans • Determine laser levels, sight levels and line (also known as string levels)	• Describe grade checking devices and tools • Describe laser levels, sight levels and line	Theory- 02 Hrs. Practical- 04 Hrs. Total- 06 Hrs.	Nil	Class Room and Workshop
LU9. Review job specifications and safety considerations with site personnel	• Communicate with site supervisor to confirm job specifications • Identify safety concerns, such as location of utilities	• Describe duties of site supervisor and job specifications • Describe safety precautions and location of utilities on job site	Theory- 01 Hrs. Practical- 02 Hrs. Total- 03 Hrs.	Nil	Class Room and Workshop

4. List of Tools and Equipment

(FOR A CLASS OF 25 STUDENTS)

Name of Trade	**Heavy Machine Operator**
Duration of Course	**Months**

Sr. #	Description	Quantity
1.	Steel-Toed Footwear,	30
2.	Hard Hat,	30
3.	Safety Gloves,	30
4.	Appropriate Safety Glasses,	30
5.	High Visibility Vest,	30
6.	Hearing Protection,	30
7.	Breathing Apparatus,	04
8.	De-Electric Boots and Gloves for Protection from Electrical Shock.	10
9.	Fall Protection, And Other Applicable PPE	30
10.	Site Emergency Response Plan,	30
11.	Fire Extinguishers,	04
12.	Fire Blankets,	04
13.	Respirators, Masks,	30
14.	Fire Hoses,	08
15.	First Aid Kits, Stretchers, WHMIS Book, And Other Related Tools and Gear	04 sets
16.	Basic Tools, Such as Grease Gun, Air Pump Etc.	25 sets
17.	Hammer,	05 each size
18	Screwdrivers,	05 each size
19.	Pliers,	05 each size
20.	Self-Locking Pliers,	05 each size

21.	Adjustable Wrench,	05 each size
22.	Assorted Other Wrenches, Measuring Tape(100m)	05 each size
23.	Basic Supplies, Such as Grease, Oil, Window Cleaner, Rags, Ice Scraper, Whisk Broom.	05 each
24.	Color-code cards, utility documentation. Logbooks Service Manuals, OHS Regulation,	10 sets
25.	**MACHINES**	
26	**A. Bulldozer.** Attachments: - 1. Blades. 2. Ripper	01 each
27	**B. Excavator (Wheel & Crawler).** Attachments: - 1. Buckets. 2. Grappler. 3. Coupler. 4. Thumbs. 5. Pulverize. 6. Lifter. 7. Rakes. 8. Chuck 9. Blades. 10. Ripper. 11. Forks. 12. Adapter. 13. Hammer. 14. Auger. 15. Compactor. 16. Stump Harvester. 17. Driller	01 each
28	**C. Motor Grader.** Attachments: - 1. Angle Blade. 2. Lift Group. 3. One-way Plow. 4. Snow Gate. 5. Snow Wing. 6. Straight Blade, 7. UV Angle Blade. 8. V-Plow	01 each
29	**D. Wheel Loader.** Attachments: - 1. Coupler. 2. Dozer Blade. 3. Boom Poles. 4. Bucket. 5. Fork. 6. Grappler. 7. Snow Blade, 8. Trailer Hitches. 9. Rotary Sweeper. 10. Broadcast Spreader	01 each

5. Specification of Machines & Consumable

A. Bulldozer Specification & Consumable

S.#	Length (mm)	D50A-17	D65A-8	D85-18/D85A	D155A-1
1.	Overall Length	4765	5135	5750	6880
2.	Overall Width	2145	3970	3725	4130
3.	Overall Height	2900	3020	3395	3720
4.	Overall Op Weight	12240	15890	23510	33690
5.	Ground Clearance	315	400	400	500
6.	Track Shoes Width	460	460	560	560
7.	Grade Ability (degree)	30	30	30	30
8.	Ground Pressure (kg/cm^2)	0.62	0.67	0.62	0.77
9.	Horse Power	120	165	220	320
10.	Type of Dozer	Angle	Tilt	Tilt	Tilt
11.	Fuel (LT)	250	320	450	660
12.	Engine Oil-SAE 30 (LT)	30	30	43	71
13.	Hydraulic Oil (LT)	87	108	110	164
14.	Transmission Oil (LT)	18	52	122	185
15.	Cooling Water (LT)	52	63	79	165
16.	Steering Oil (LT)	63	70	Nil	Nil
17.	Final Drive Case Oil (LT)	52 (26 each side)	62 (31 each side)	72 (36 each side)	110 (55 each side)

B. Excavator Specification & Consumable.

S#	Specification	PC 120	PC 150	PC 200
1	Bucket Capacity (m^3)	0.50 m^3	0.55 m^3	0.7 m^3
2	Operating Weight (Kg)	12030 kg	14500 kg	18000 kg
3	Overall Length (mm)	7050	8350	9380
4	Overall Width (mm)	2500	2550	2740
5	Overall Height (mm)	2700	2900	2940
6	Swing Speed (rpm)	20	19.6	13
7	Travel Speed (Km/h)	3 km/h	3.2 km/h	3.5k m/h
8	Grade ability (Degree)	25 % to 30%	35%	35%
9	Ground Pressure (Kg/cm^2)	0.45 Kg/cm^2	0.47 Kg/cm^2	0.47 Kg/cm^2
10	Max. Excavation (mm)	3060	5400	6550
11	Max. Stockpile (mm)	4420 mm	5530 mm	6255 mm
12	Max. Stretch (mm)	7050 mm	8440 mm	9850 mm
13	Horsepower (HP)	85.4 HP	86 HP	106 HP
14	Fuel Capacity (LT)	230 LT	280 LT	540 LT
15	Engine Oil (LT)	11 LT	24 LT	24 LT
16	Hydraulic Oil (LT)	100 LT	250 LT	250 LT
17	Swing case Oil (LT)	2.5 LT	7 LT	8 LT
18	Water (Lt)	15.7 LT	24 LT	24 LT
19	Track Chain Pulley	20 to 25 mm	20 to 25 mm	60 to 100 mm
20	Final Drive	Each side	Each side	Each side
		2.5 LTR	2.5 LTR	7.4 LTR

C. Motor Grader Specification & Consumable.

S.#	Detail	MG 200	MG 330	MG 430	GD-605-A3
1.	Heaped Blade Capacity	3.06 m^3	3.9 m^3	1.01 m^3	3.9 m^3
2.	HP (Horse Power)	115 hp	135 hp	155 hp	145 hp
3.	Op/Weight	9885 kg	10920 kg	12220 kg	12870 kg
4.	Fuel	210 ltr	230 ltr	275 ltr	250 ltr
5.	Engine Oil	12 ltr	13 ltr	13 ltr	24 ltr
6.	Hydraulic Oil	70 ltr	67 ltr	67 ltr	60 ltr R/Fel
7.	Transmission	40 ltr	23 ltr	32 ltr	30 ltr
8.	Water	21 ltr	34 ltr	46 ltr	45 ltr
9.	Tire Pressure	2.25	1.8	2.6	2.45kg
10.	Gear Oil/Final Drive	2.5 ltr	3.4 ltr	3.5 ltr	26 CTR
11.	Tandem Oil	48 ltr	73 ltr	85 ltr	72 tr 36X36

D. Wheel Loader Specification & Consumable

S#	Items	WA 450	WA 320	WA 200	966 F cat	928 F cat
1	Horsepower (HP)	237	165	110	220	120
2	Operating Weight (Kg)	19100	13450	92100	20905	11148
3	Bucket Capacity (m^3)	3.5	2.8	1.7	3.8	2
4	Grade ability (Degree)	30	35	33	35	35
5	Speed/Hour	34-38	38	37	48	45
6	Fuel (LT)	330	228	170	304	189
7	Engine Oil (LT)	32	19.5	24	28	20
8	Hydraulic Oil (LT)	230	89	83	205	100
9	Transmission Oil (LT)	61	74	35	59	30
10	Cooling Water (LT)	65	20	38	48	41
11	F/R Axle oil (LT)	120	48	34	47	50
12	Tire Pressure (Kg/cm^2)	2.8	2.5	2.5	2.8	2.5

5. List of Stationary

Sr. #	Description
1.	Handbooks
2.	Design books
3.	Pencils
4.	Rubber
5.	Sharpeners
6.	Paper cutter
7.	Scissors
8.	Colours
9.	White charts
10.	Brown sheets
11.	White board markers
12.	Permanent markers
13.	File cover and files

6. Members of the Curriculum Development Committee

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