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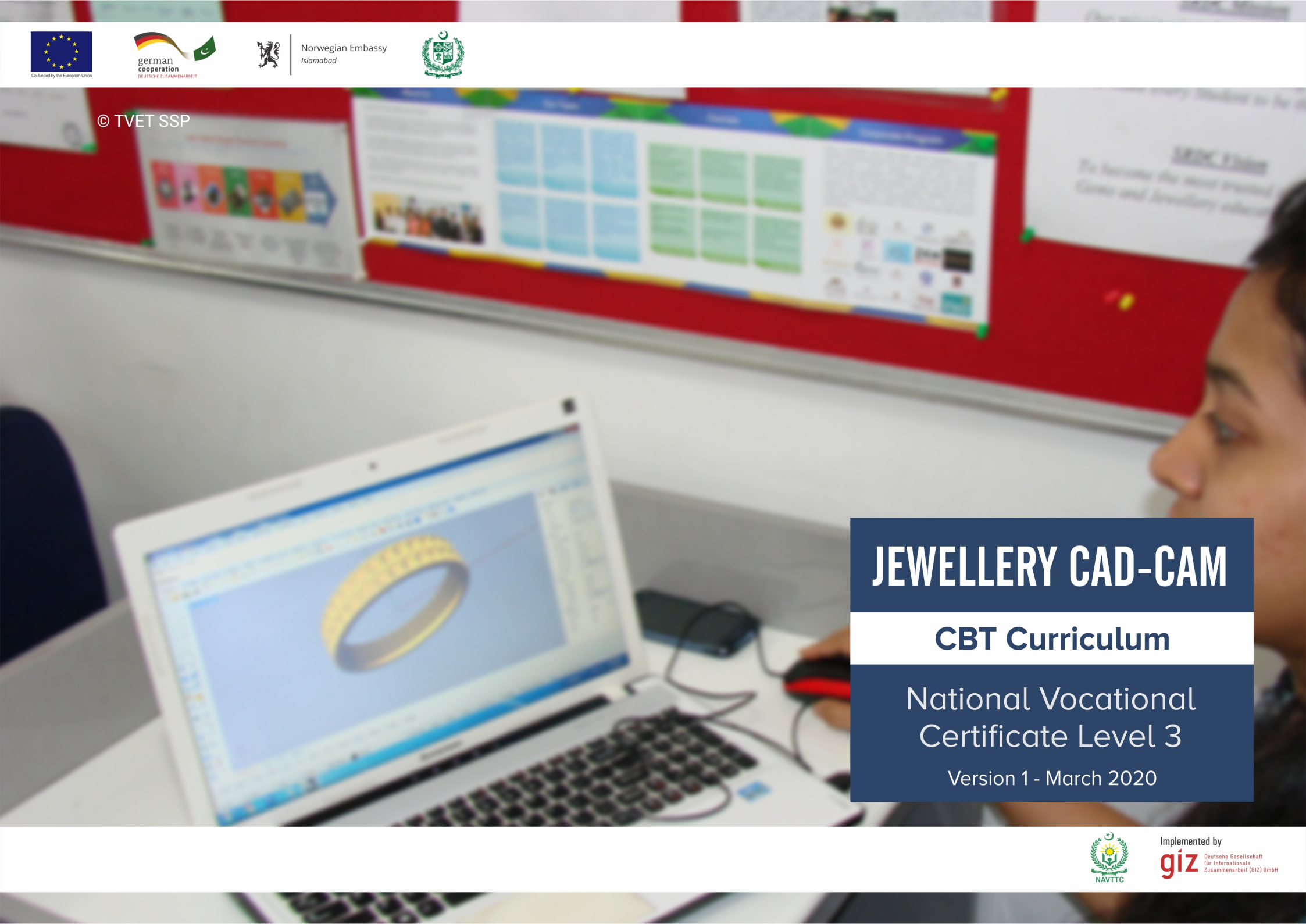

JEWELLERY CAD-CAM

CBT Curriculum

National Vocational Certificate Level 3

Version 1 - March 2020

NAVTTC

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TABLE OF CONTENTS

1. TITLE OF QUALIFICATION

National Vocational Certificate level 3, in (Gems and Jewellery Sector) “Jewellery CAD-CAM “

2. MEMBERS OF QUALIFICATIONS DEVELOPMENT COMMITTEE

The following members participated in the qualifications development and validation of these qualifications:

NAME	DESIGNATION	ORGANIZATION	CONTACT
Bashir Agha	(DACUM Facilitator)/ Principal	GJTMC- Quetta	03218119120
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Introduction

Industry and academic experts from different geographical locations across Pakistan were consulted during the development process of this curriculum to ensure input and ownership of all the stakeholders. The National Competency Standards are used as a reference document for the development of curricula to be used by training institutions.

This qualification shall provide skilled manpower for the value addition on Gemstone and Jewellery of the existing Gems and Jewellery sector and related industry. This will improve the abilities and accreditation of a CAD-CAM Jewellery Designing in terms of national and international standards applicable in the field of Gems and Jewellery. The availability of quality Jewellery Designing in the local and international markets will ultimately bring economic benefits to the producers and processors. In addition this qualification will prepare youth to be employee in industry or work as an entrepreneur. Main purpose is to prepare and train students through skill training and enable them to earn their living either through employment in industry or to be self-employed

Definition/ Description of the training program

Training in the course is based on defined competency standards, which are industry oriented, here the traditional role of a trainer changes and shifts towards the facilitation of training. A trainer encourages and assists trainees to learn for themselves. Trainees are likely to work in groups (pairs) and all doing something different. Some are doing practical tasks in the workshop, some writing, some not even in the classroom or workshop but in another part of the building using specialist equipment, working on computers doing research on the Internet or the library. As trainees learn at different pace they might well be at different stages in their learning, thus learning must be tailored to suit individual needs. The following facilitation methods (teaching strategies) are generally employed:

- **Direct Instruction Method:** This might be effective when introducing a new topic to a larger group of trainees in a relative short amount of time. In most cases this method relies on one-way communication, hence there are limited opportunities to get feedback on the trainee's understanding.

- **Discussion Method:** This allows trainees to actively participate in sharing knowledge and ideas. It will help the trainer to determine whether trainees understand the content of the topic. On the other hand, there is a possibility of straying off topic under discussion and some trainees dominating others on their views.
- **Small Group Method:** Pairing trainees to help and learn from each other often results in faster knowledge/skill transfer than with the whole class. The physical arrangement of the classroom/workshop and individual assessment may be challenging. Analogy method should be in corporate.
- **Problem Solving Method:** This is a very popular teaching strategy for the training. Trainees are challenged and are usually highly motivated when they gain new knowledge and skills by solving problems (Contingency skills). Trainees develop critical thinking skills and the ability to adapt to new learning situations (Transfer skills). It might be time consuming and because trainees sometimes work individually, they may not learn all the things that they are expected to learn.
- **Research Method:** This is used for workshops and laboratory tasks, field experiments, and case studies. It encourages trainees to investigate and find answers for themselves and to critically evaluate information. It however requires a lot of time and careful planning of research projects for the trainee.

Purpose of the training programme

The core purpose of this qualification is to produce employable Computer Aided Jewellery designers, who could provide advanced services in Jewellery designing. In addition this qualification will prepare youth to be employee in industry or work as an entrepreneur. Main purpose is to prepare and train students through skill training and enable them to earn their living either through employment in industry or to be self-employed.

Overall objectives of training programme

The objective of this training is to set high professional standards for Jewellery CAD-CAM trade. The specific objectives of developing these qualifications are as under:

- Fulfil workforce needs of Gems and Jewellery sector
- Improve the personal and professional competence
- Provide opportunities for recognition of skills attained through formal or informal pathways
- Improve the quality and effectiveness of training and assessment
- Provide opportunities to reduce unemployment ratio through aforesaid skills set

Competencies to be gained after completion of course

At the end of the course, the trainee must have attained the following competencies:

- Prepare Drawing of Basic Jewellery Article Manually
- Create Computer Aided Drawing of Basic Level Jewellery
- Create Computer Aided Drawing of Intermediate Level Jewellery
- Create Computer Aided Drawing of Advance Level Jewellery
- Produce Prototype of Jewellery Article using 3D Printer

Possible available career opportunities available immediately and later in the future

After completion of this course trainees can be employed in government / semi-government / private organizations or can be self-employed as jewellery CAD-CAM designer and prototyping expert. Keeping in view the potential that the jewellery CAD-CAM designing and prototyping holds will provide livelihood opportunities to the youth and in particular to the women in Pakistan.

Trainee entry level

The entry for National Vocational Certificate level 3, in Jewellery CAD-CAM is Middle grade or equivalent. Entry to assessment for this qualification is open.

Minimum qualification of trainer

Resource person should have at least two (3) years' practical experience related to CAD-CAM Jewellery. Beside this the incumbent should also holds Higher Secondary Certification.

Recommended trainer: trainee ratio

Recommended trainer: trainee rations 1:20, but can be vary as per the capacity of Institute.

Medium of instruction i.e. language of instruction

Urdu and English

Duration of the course (Total time, Theory & Practical time)

This curriculum comprises 5 modules. The recommended delivery time is 800 hours. Delivery of the course could therefore be full time, 5 days a week, for 6 months. Training providers are at liberty to develop other models of delivery, including part-time and evening delivery.

The full structure of the course is as follow:

Module	Theory[1] hours	Workplace[2] hours	Total hours
Module-1: Prepare Drawing of Basic Jewellery Article Manually	35	65	100
Module-2: Create Computer Aided Drawing of Basic Level Jewellery	50	150	200
Module-3: Create Computer Aided Drawing of Intermediate Level Jewellery	30	170	200
Module-4: Create Computer Aided Drawing of Advance Level Jewellery	38	162	200
Module-5: Produce Prototype of Jewellery Article using 3D Printer	25	75	100

Sequence of the modules

The modules shall be taught in the following sequence;

Module-1: Prepare Drawing of Basic Jewellery Article Manually
Module-2: Create Computer Aided Drawing of Basic Level Jewellery
Module-3: Create Computer Aided Drawing of Intermediate Level Jewellery
Module-4: Create Computer Aided Drawing of Advance Level Jewellery
Module-5: Produce Prototype of Jewellery Article using 3D Printer

1 Learning Module hours in training provider premises
2 Training workshop, laboratory and on-the-job workplace

Summary – overview of the curriculum

Module Title and Aim	Learning Units	Theory Days/ hours	Workplace Days/ hours	Timeframe of modules
Module 1: Prepare drawing of basic jewellery article manually **Aim:** Performing the basic manual jewellery designing enable trainee to draw the basic sketch and technical drawings of jewellery motifs and article before going for CAD.	**LU1:** Perform Basic Sketching **LU2:** Draw Technical drawings of Jewellery Articles	35	65	100
Module 2: Create Computer Aided Basic Level Jewellery **Aim:** the purpose of this module is to enable the trainee in understanding of the use of setup interface of jewellery CAD software, creating 2D drawings, designing computer aided 3D model of simple jewellery article while using CAD software and performing basic rendering.	**LU1:** Setup interface of Jewellery CAD software **LU2:** Create 2D Drawings **LU3:** Create Basic level jewellery article. **LU4:** Perform Basic level Rendering	50	150	200
Module 3: Create Computer Aided Jewellery of Intermediate level **Aim:** the purpose of this module is to enable the trainee in designing computer aided 3D model of semi complex jewellery article while using CAD software.	**LU1:** Create intermediate level Jewellery Article (Rings, Earing, Bangles and Pendants). **LU2:** Perform Intermediate level Rendering	30	170	200
Module 4: Create Computer Aided Jewellery Article of Advance Level. **Aim:** the purpose of this module is to enable the trainee in designing computer aided 3D model of complex jewellery article while using CAD software.	**LU1:** Create Advance level Jewellery Article (Rings, Earing, Bangles, Pendants and Bracelets). **LU2:** Perform Advance Rendering **LU3:** Generate CAM file	38	162	200
Module 5: Produce prototype of jewellery article using 3D printer **Aim:** The purposes undermine this module is to enable a trainee for preparing CAM file and to produce 3D jewellery model on CAM machine.	**LU1:** Identify personal hazards at work place **LU2:** Prepare CAM file for 3D Printing (Rapid Prototyping) **LU2:** Print 3D Jewellery model on CAM machine	25	75	100

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Module-1

MODULES

MODULE 1: PREPARE DRAWING OF BASIC JEWELLERY ARTICLE MANUALLY

Objective of the module: Performing the basic manual jewellery designing enable trainee to draw the basic sketch and technical drawings of jewellery motifs and articles before CAD.

Duration: 100 Theory: 35 Practical: 65

Learning Unit	Learning Outcomes	Learning Elements	Duration HRS	Materials /Tools Required	Learning Place
LU1: Perform Basic Sketching	**The trainee will be able to:** • Analyse jewellery article on measurements • Draw outline sketch of basic jewellery article with free hand • Draw jewellery design elements.	• Basic concept of Jewellery including • Eras of Jewellery Development • Identify and use of sketching material • Method of holding pencils • Various types & Methods of lines (vertical & horizontal) • Various types of hatching lines on angles • Variation of line and • Free hand Sketching of different daily use objects • Sketching and drawing techniques	**Total:** 50 **Theory:** 20 **Practical:** 30	• Pencils HB • Eraser, Sharpener • Stencils • Templates • Drawing sheet(A4,A3,A2) • Drawing boards • Paper cutter • Steel Ruler • Masking Tape	Theory: Class Room/ Computer Lab Practical: Computer Lab
LU2: Draw Technical drawings of Jewellery Articles	**The trainee will be able to:** • Analyse jewellery article on measurements • Draw three views of the jewellery article • Draw cross sections. • Mark dimensions on the	• Difference between Jewellery Motif & Article • International Measuring Systems for Gems and Jewellery • Jewellery measuring instruments • Various Jewellery motif • Geometrical shapes (Round, Square, Triangle, Rectangle, Polygon)	**Total:** 50 **Theory:** 15 **Practical:** 35	• Digital Vernier Callipers • Wire Gauge • Steel Ruler • Ring Sizer	Theory: Class Room/ Computer Lab

	drawing • Add design elements to three views. • Draw drawing panel.	• Use of geometry tool set • Gemstone shapes and cuts • Wear ability parameters of jewellery designs • Orthographic (3D) projections of jewellery elements • Angle of projections & perspective Views (1-point & 2-Point Perspective)			Practical: Computer Lab

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Module-2

MODULE 2: CREATE COMPUTER AIDED DRAWING OF BASIC LEVEL JEWELLERY

Objective of the module: the purpose of this module is to enable the trainee in understanding of the use of setup interface of jewellery CAD software, creating 2D drawings, designing computer aided 3D model of simple jewellery article while using CAD software and performing basic rendering.

Duration: 200 Theory: 50 Practical: 150

Learning Unit	Learning Outcomes	Learning Elements	Duration HRS	Materials Required	Learning Place
LU1: Setup interface of Jewellery CAD software	***Trainee will be able to:*** • Analyse jewellery article on measurements • Set up commonds in CAD Jewellery software. • Scan and import image of manual 2D drawing if required.	• Computer hardware specification & operating system • Compatibility & Installation of Jewellery CAD software • Use of main & sub menus (Command Prompt, View ports, History ,Snaps, Layers, Info & Settings menus, Project Manager • Various 2D & 3D View ports • Reference Axis-X,Y,Z • Grid & Measuring Units • Scrolling of mouse for various commands	**Total:** 50 **Theory:** 20 **Practical:** 30	• Computer Machine as per software compatible • Operating system (Windows Pack) • Jewellery Design Software (Rhinoceros 3D & Matrix)	Theory: Class Room/ Computer Lab Practical: Computer Lab
LU2: Create 2D Drawings	**Trainee will be able to:** • Draw three views of the jewellery article • Mark dimensions on the drawing • Add design elements to three views. • Draw cross sections	• Various types of jewellery shapes (Round ,Tapered , Square, Rectangle, Marquise, Pear/Drop, Polygon ,Oval, Paisley, Heart, Moon, Star, leaf, Spirals) • Definition of basic Jewellery articles (Band ,Ring ,Earing, Pendant) • Use of File Menu “New ,Open, Save ,Save as • Use of Curve Menu “Point , Single Line,	**Total:** 50 **Theory:** 10 **Practical:** 40	• Computer Machine as per software compatible • Operating system (Windows Pack) • Jewellery	Theory: Class Room/ Computer Lab Practical: Computer Lab

		Polyline, Rectangle, Polygon, Freeform, Circle, Arc, Ellipse, Parabola, Hyperbola, Conic, Rebuild) • Use of Edit Menu "Undo, Redo, Cut, Copy Paste, Delete, Join, Explode, Trim, Split) • Use of Transform Menu "Move/Drag/Gumball, ,Duplicate/Copy ,Rotate , Mirror) • Use of View Menus Restore View Ports, Pan, Rotate, Zoom, Picture Frame • Use of keyboard for execution of short key commands • Methods of precision and accuracy by using Snap, Grid ,Unites • Saving of File through Project Manager • Differentiate between Metric and Imperial Measuring systems		Design Software (Rhinoceros 3D & Matrix) • Digital Vernier Callipers • Steel Rule • Wire Gauge • Ring Sizer • Bangle Sizer	
LU3: Create 3D Drawings	**Trainee will be able to:** • Generate 3D surface using profiles, cross sections etc. • Place simple design components (Gemstone, metal inserts etc.) on jewellery article if required. • Assign material to 3D model and calculate	• Using Surface & Solid Menus to create Box (Cube, Cuboid), Sphere, Cylinder, Cone, Tube, Pyramid, Cone, Truncated Cone, Ellipsoid, Paraboloid, Pipe, Slab, Torus, and Text. • Measurement of 3D shapes by using Dimension Menu- (Linear, Align, Rotated, Radial ,Diameter ,Angle) • Execute of Gem shapes using Gem Menu – Round, Oval, Cushion, Princess, Pear,	**Total:** 80 **Theory:** 15 **Practical:** 65	• Machine as per software compatible • Operating system (Windows Pack) • Jewellery Design Software (Rhinoceros 3D	Theory: Class Room/ Computer Lab Practical: Computer Lab

	weight of jewellery article and its components.	Marquise, Emerald, Radiant, Trillian, Baguette, Heart, Calf, and Half Moon. • Use of Layers Menus for distribution and highlight of constructed articles. • Hide/Show of constructed articles by using layer menu • Create different styles shanks according to profiles • Construction of Shank according to Standard ring sizes and measurements • Incorporate single gem through Gem loader, Head Builder and Bezel Builder. • Define standard height and thickness of prongs. • Types of Stone Settings(Prongs, Flush , Bezel, Channel, Cluster settings) • Import Picture in standard file format by using View Menu • Generate surfaces in solid through Sweep, Cap Planner & Extrude commands. • Use measuring gauges/instruments like steel ruler ,Vernier Callipers, Wire gauge to measure length and thickness • Calculate Cartage weight of metal by using command “Metal Weight” • Calculate Carat weight and quantity of gems		& Matrix) • Digital Vernier Callipers • Steel Rule • Wire Gauge • Ring Sizer • Bangle Sizer	

		by using command “Gem Reporter” • Various types of Precious & semi-precious metals used in jewellery manufacturing • Do appropriate drilling holes for gems using different cutters • Methods of material subtraction / addition associated through Boolean Operations			
LU4: Perform Basic level Rendering	***Trainee will be able to:*** • Prepare 3D model for presentation. • Apply pre-set parameters as per environment • Render 3D model	• Rendering Phenomenon & various rendering software • Various Rendering tools and parameters • Types of Picture file format and VGA resolutions. • Various colours/tones of jewellery articles and gemstone according to metals and Karat respectively.	**Total:** 20 **Theory:** 5 **Practical:** 15	• Machine as per software compatible • Operating system (Windows Pack) • Jewellery Design Software (Rhinoceros 3D & Matrix) • Printer (Colour) • Paper cutter	Theory: Class Room/ Computer Lab Practical: Computer Lab

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Module-3

MODULE 3: CREATE COMPUTER AIDED DRAWING OF INTERMEDIATE LEVEL JEWELLERY

Objective of the module: the purpose of this module is to enable the trainee in designing computer aided 3D model of semi complex jewellery article while using jewellery CAD software and performing rendering.

Duration: 200 **Theory: 30** **Practical: 170**

Learning Unit	Learning Outcomes	Learning Elements	Duration HRS	Materials Required	Learning Place
LU1: Setup interface of Jewellery CAD software	***Trainee will be able to:*** • Analyse jewellery article on measurements (Rings, Earing, Bangles and Pendants). • Set up commands in CAD Jewellery software.	• Various Jewellery Measuring instruments (Digital Vernier Callipers, Wire gauge, Steel Ruler, Ring & bangle size chart) • Investigate standard surfaces thickness.	**Total:** 20 **Theory:** 5 **Practical:** 15	• software compatible Machine • Operating system (Windows Pack) • Jewellery Design Software (Rhinoceros 3D & Matrix) • Printer (Colour)	Theory: Class Room/ Computer Lab Practical: Computer Lab
LU2. Create 2D Drawing	**The trainee will be able to:** • Scan and import image of manual 2D drawing if required. • Create 2D drawing	• Standard Picture format. • Anatomy of surfaces (flat and dome) • Definition of intermediate Jewellery articles (Band ,Ring ,Earing, Pendant) • Use of File Menu “New ,Open, Save ,Save as • Use of Curve Menu “Point , Single Line, Polyline, Rectangle, Polygon, Freeform, Circle, Arc, Ellipse, Parabola, Hyperbola, Conic, Rebuild)	**Total:** 60 **Theory:** 10 **Practical:** 50	• Machine as per software compatible • Operating system (Windows Pack) • Jewellery Design Software (Rhinoceros 3D & Matrix) • Paper Printer (Colour) • Steel Rule	Theory: Class Room/ Computer Lab Practical: Computer Lab

		• Use of Edit Menu “Undo, Redo, Cut, Copy Paste, Delete, Join, Explode, Trim, Split) • Use of Transform Menu “Move/Drag/Gumball, ,Duplicate/Copy ,Rotate , Mirror) • Use of View Menus Restore View Ports, Pan, Rotate, Zoom, Picture Frame • Use of keyboard for execution of short key commands • Methods of precision and accuracy by using Snap, Grid ,Unites • Saving of File through Project Manager • Differentiate between Metric and Imperial Measuring systems		• Paper cutter • Ring Filer	
LU 3: Create 3D Drawing	**The trainee will be able to:** • Generate 3D surface using cross sections etc. • Place intermediate level design components (Gemstone, metal inserts etc.) on jewellery article. • Assign material to 3D	• Creating multi stone rings with multiple surfaces • Creating multi stone earrings with multiple and complex surfaces • Creating bangles with multiple and complex surfaces • Drilling holes for gems using different cutters • Types of Stone Settings (Pave, Cluster, Tension setting) with standard gauge thickness	**Total:** 100 **Theory:** 10 **Practical:** 90	• Machine as per software compatible • Operating system (Windows Pack) • Jewellery Design Software (Rhinoceros 3D & Matrix) • Paper Printer (Colour) • Steel Rule • Paper cutter	Theory: Class Room/ Computer Lab Practical: Computer Lab

	model and calculate weight of jewellery article and its components. • Create specs sheet of designed jewellery article.	• Methods of material subtraction / addition associated through Boolean Operations • Ensuring water tight 3D model by using Object Checker. • Calculating Karat weight of metal by using command “Metal Weight” • Calculating Carat weight and quantity of gems by using command “Gem Reporter”		• Ring Filer	
LU4: Perform Intermediate level Rendering	***Trainee will be able to:*** • Prepare 3D model for presentation. • Apply customized parameters. • Create animation of 3D Jewellery Article for presentation	• Position and elevate Jewellery Article in perspective View • Remove curves and duplicate objects (gems & surfaces) • Assign pre-defined background • Use pre-defined colours/tones according to metals and Cartage. • Use pre-defined colours/tones according gemstone • Types of Picture file format and VGA resolutions.	**Total:** 20 **Theory:** 5 **Practical:** 15	• Machine as per software compatible • Operating system (Windows Pack) • Jewellery Design Software (Rhinoceros 3D & Matrix) • Printer (Colour)	Theory: Class Room/ Computer Lab Practical: Computer Lab

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Module-4

MODULE 4: CREATE COMPUTER AIDED DRAWING OF ADVANCE LEVEL JEWELLERY ARTICLE.

Objective of the module: the purpose of this module is to enable the trainee in designing computer aided 3D model of semi complex jewellery article using CAD software and performing advance rendering

Duration: 200 **Theory: 38** **Practical: 162**

Learning Unit	Learning Outcomes	Learning Elements	Duration HRS	Materials Required	Learning Place
LU1: Setup interface of Jewellery CAD software	**The trainee will be able to:** • Analyse jewellery article on measurements (Rings, Earing, Bangles, and Pendants etc.) • Set up commands in CAD Jewellery software.	• Importing 2D drawing views / sketch. • Importing picture image of various views of article on scale to replicate physical model. • Measurements by using Digital Vernier Callipers, Wire gauge, Steel Ruler, Ring & Bangle size charts. • Standard sizes of Rings, Earrings, Bangles, Sets, Choker, Broach, Anklet, Bracelets, and Cufflinks by using International Charts.	**Total:** 10 **Theory:** 2 **Practical:** 8	• Machine as per software compatible • Operating system (Windows Pack) • Jewellery Design Software (Rhinoceros 3D & Matrix) • Printer (Colour)	Theory: Class Room/ Computer Lab Practical: Computer Lab
LU2. Create 2D Drawing	**The trainee will be able to:** • Scan and import image of manual 2D drawing if required. • Create 2D Drawing	• Developing line work of article by using Curve Menu and commands : Ring Rail ,Profile Placer ,Outside Rail ,Interpret Curve, Single Line ,Polyline , Offset Curve ,Rebuild ,Arc Direction ,Extract ISO Curve, Extract ISO Curve, Create UV Curve, Apply UV Curve, Project ,Pullback , Duplicate Curve, Curve from 2 Views, Fillet ,Chamfer, Divide Curve	**Total:** 50 **Theory:** 10 **Practical:** 40	• Machine as per software compatible • Operating system (Windows Pack) • Jewellery Design Software (Rhinoceros 3D & Matrix)	Theory: Class Room/ Computer Lab Practical: Computer Lab

		,Extent Curve. • 2D Surface Menu (Sweep 1 & 2), Loft, Revolve, Rail Revolve Patch, Planner Curve, Curve Network, Merge Surfaces.		• Paper Printer (Colour) • Steel Rule • Paper cutter	
LU3. Create 3D Drawing	**The trainee will be able to:** • Generate 3D surfaces using rails, cross sections etc. • Place advance level design components on jewellery article • Assemble different parts (links, hinges and findings etc.) of jewellery article. • Assign material to 3D model and calculate weight of jewellery article and its components. • Create specs sheet of designed jewellery article.	• Generating 3D surfaces using Solid & Surface Menus (Extrude Surface, Extrude Curve, Cap Planner, Offset Surface, Blend Surface, Pipe, Slab, Rib, Fillet, Blend, and Chamfer Edge. • Replicating objects and gems by using commands Duplicate/Copy, Array Menu if required. • Scale of surfaces using commands Scale 1D, Scale 2D, Scale 3D and Dimension Menu. • Types of Jewellery Manufacturing Techniques(2-tone , Filigree, Art work, Wire, Hatch, Texture using commands Helix, Spiral ,Object on Curve, Pattern Builder , Rotate 3D ,Flow along Curve ,Flow along Surface, Smart Flow ,Cage Edit, Bend ,Stretch ,Shear, Orient 2 Point , Orient on surface ,Project 2 C-Plane, Twist, Symmetry, Align. • Placement of assorted gems by shapes and quantity through Gem Menu (Gem	**Total:** 85 **Theory:** 15 **Practical:** 70	• Machine as per software compatible • Operating system (Windows Pack) • Jewellery Design Software (Rhinoceros 3D & Matrix) • Printer (Colour)	Theory: Class Room/ Computer Lab Practical: Computer Lab

		on Curve ,Gem on Surface ,Gem Profile, Gem Position, Gem Guide ,Taper Baguette ,Gem Between Curves, Cluster gems, Custom Gem Builder, Gem update ,Gem control • Use respective setting of gem(s) by using commands Head Builder, Bezel Builder, Scallop Bezel, Prong Builder, Prong Editor, and Prong on Surface, Bead on Surface, Pave Builder, Eternity Builder, Metal from gem. • Incorporate cutters of assorted gems by using commands Gem Cutter, Azure Cutter, Channel Cutter, Micro Prong Cutter, Bright Cut Channel, Bright Cut Cutter Cut to finger Rail, Plane Cube Cutter. • Apply Boolean Operations for material subtraction and addition (Subtraction/ Difference, Union, Intersection) • Ensure 3D solid and water tight model by using command “Object Check” • Analyse and repair bad and naked edges in surfaces by using command “Extract bad edges , Show Edges, Join 2 naked edges” if required.			

		• Calculate Cartage weight of metal by using command “Metal Weight” • Calculate Carat weight and quantity of gems by using command “Gem Reporter” • Ensure manufacturing parameters /aspect of 3D model in term of Casting, Sawing ,Piercing, Filing , Wear ability ,Soldering ,Drilling • Hinges & Fittings to assemble jewellery parts			
LU4: Perform Advance Rendering & Animation	***Trainee will be able to:*** • Prepare 3D model for presentation. • Apply customized parameters Create customized background image (s) / logo (s). • Create customized colour of metal according to Cartage. • Create customized colour of gems and pearls. • Assign colour of	• Rendering Phenomenon & Various Rendering Software • Various Rendering tools and parameters • Types of Picture file format and VGA resolutions. • Methods of customized Background. • Various colours/ tones of jewellery articles according to metals and Karat. • Various colours of gems and pearls. • Colour of Enamelling film	**Total:** 50 **Theory:** 10 **Practical:** 40	• Machine as per software compatible • Operating system (Windows Pack) • Jewellery Design Software (Rhinoceros 3D & Matrix) • Printer (Colour)	Theory: Class Room/ Computer Lab Practical: Computer Lab

	enamelling film (if required). • Execute advance level rendering of 3D Jewellery Article. • Create advance level (object and camera) animation of 3D Jewellery Article for presentation.				
LU5: Generate CAM file	**Trainee will be able to:** • Ensure 3D solid model is water tight and excludes gems, naked edges, duplicate and open surfaces. • Export CAD file of 3D jewellery model according to CAM file format.	• Segregation of Curves, Gems, naked edges, open and duplicate surfaces. • Validation of 3D CAD models • CAM file format and resolution	**Total:** 5 **Theory:** 1 **Practical:** 4	• Machine as per software compatible • Operating system (Windows Pack) • Jewellery Design Software (Rhinoceros 3D & Matrix)	Theory: Class Room/ Computer Lab Practical: Computer Lab

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Module-5

MODULE 5: PRODUCE PROTOTYPE OF JEWELLERY ARTICLE USING 3D PRINTER

Objective of the module: The purposes undermine this module is to enable a trainee for preparing CAM file and to produce 3D jewellery model on CAM machine.

Duration: 100 **Theory: 20** **Practical: 80**

Learning Unit	Learning Outcomes	Learning Elements	Duration HRS	Materials Required	Learning Place
LU1: Identify personal hazards at work place	**The trainee will be able to:** • Identify hazards and risks at work place • Identify risk control measures. • Segregate hazardous or non-hazardous wastes as per approved procedure. • Use personal protective equipment according to risk at workplace.	• Hazards ,Exposure and Risks • Personal protection and safety equipment. • Safety signs and symbols • Safety related standards operating procedures/guidelines , best practices • Waste disposal methods of hazardous substances.	**Total:** 10 **Theory:** 5 **Practical:** 5	• Personal protective equipment	Theory: Class Room/ Isolated Lab
LU2 Prepare CAM file for 3D Printing (Rapid Prototyping)	***Trainee will be able to:*** • Import CAD file into printable format in CAM software • Fix surface errors of CAD file using commands & tools of CAM software. • Perform support generation of 3D Jewellery model • Determine estimated Production Time, Weight &	• Various CAM file formats for 3D printer • Types of surfaces errors in 3D Jewellery Modeller • educe file size according to geometry of 3D Jewellery Model • Method of Support generation according to surface Anatomy • Method for Calculating estimated Production Time, Shrinkage, Weight	**Total:** 50 **Theory:** 10 **Practical:** 40	• 3D Printer (Jewellery Specific) with accessories • Ultrasonic Cleaner • UV-Curing Unit • Weighing Scale Machine (0-50 gm) • Air Blower (with regulator and nozzle • Operating system	Theory: Class Room/ Isolated Lab

	Shrinkage of 3D jewellery model in CAM material.	/ Volume.		• Digital Vernier Callipers	
LU3: Print 3D Jewellery model on CAM machine	***Trainee will be able to:*** • Set parameters of CAM machine • Load printable liquid (Resin) considering minimum & maximum level. • Align and arrangement of multiple 3D jewellery models on machine platform • Build the job on CAM machine.	• Specification and parameters of 3D Printer for production • Methods of Supports removing and Curing of 3D printed Models • Supporting Equipment ,Apparatus and consumables for production of 3D Printed Models	**Total:** 40 **Theory:** 5 **Practical:** 35	• 3D Printer (Jewellery Specific) with accessories • Ultrasonic Cleaner • UV-Curing Unit • Weighing Scale Machine (0-50 gm) • Air Blower • Digital Vernier Callipers	Theory: Class Room/ Isolated Lab

GENERAL ASSESSMENT GUIDANCE FOR THE JEWELLERY CAD-CAM

Each module/ competency standard will be assessed through a combination formative assessment at the completion of each module as an internal assessment and a final summative assessments on the completion of the qualification by the Qualification Awarding Body though a qualified assessors.

Formative assessment: the institute conducts formative assessments on the completion of each module as an internal assessment by the resource person. Its purpose is to provide feedback to the trainees on real time environment:

- To the trainee: to identify achievement and areas for further improvements
- To the trainer: to evaluate the effectiveness of transfer of skill and knowledge and plan for further.

Summative assessment: On completion of the qualification the Qualification Awarding Body (QAB) conducts a formal summative assessment where the qualified national assessor declares a candidate “Competent” or “Not Yet Competent” with a detailed feed back to the trainees on the performing of the activities as per modules.

Methods of assessment

During assessment a direct observation during performance by the trainee is conducted while collecting solid evidence based on each module. Examples for direct assessment of a Jewellery electroplating and finishing expert include:

- Work performances: performing the tasks in lab for each assignment as prescribed in the modules.
- Demonstrations: performing and presenting the final out comes of the completion of each module.
- Direct questioning, where the assessor would ask the trainees questions related to their learning outcomes.
- Paper-based tests: if required the assessor will use some paper based test to know the understanding of the trainees during the leaning phase.

Indirect assessment is the method used where the performance could not be watched and evidence is gained indirectly. Indirect assessment will only be a second choice.

Principles of assessment

All assessments should be valid, reliable, fair and flexible:

Fairness refers that each trainee should get to equal chance for performing the duties during the assessment process.
Validity means that an assessment is conducted for what it claims to assess.
Reliability refers to consistency in outcomes based on performance or demonstration.
Flexibility means that the assessor has to be flexible concerning the assessment approach in evaluating the trainees for its competence.

List of tools and equipment for basic sketching and CAD

Following is the list of Tools and Equipment for the batch of 20 Students

Sr. #	Name of Item/ Equipment/ Tools	Quantity
1	Digital Vernier Callipers	1 per trainee
2	Wire Gauge	1 per trainee
3	Ring Sizer	1 per trainee
4	Bangle Sizer	1 per trainee
5	Computer Machine as per software compatible	1 per trainee
6	Operating system (Windows Pack)	1 per trainee
7	Jewellery CAD Design Software (Rhinoceros 3D & Gemvision Matrix)	1 per trainee
8	Magnifying Glass/ Eye Loop/ Glass Optivisor Head Band	1 per trainee
9	Operating system (Latest)	1 per trainee

10	Jewelry CAD Design Software (Rhinoceros 3D & Matrix)	1 per trainee
11	Steel Ruler	1 per trainee
12	Card Board Sheet A4	1 per trainee
13	Geometry box	1 per trainee
14	Pencil HB /Clutch Pencil (0.5,0.3mm)	1 per trainee
15	Eraser, Sharpener	1 per trainee
16	Jewellery Templates	1 per trainee
17	Drawing sheet(A4,A3,A2)	1 per trainee
18	Drawing boards A2 size	1 per trainee
19	File Folder/Ring File	1 per trainee
20	Paper cutter	1 per trainee
21	Masking Tape	1 per trainee
22	Technical Drawing Pen 0.5,0.3mm & cartridge	1 per trainee
23	Abrasive Paper & Cleaning Cloth	1 per trainee
24	Tracing Paper	1 per trainee
25	Glue Stick	1 per trainee

Tools and Equipment Required for Jewellery CAM

Sr. #	Name of Item/ Equipment/ Tools	Quantity
1	3D Printer (Jewelry Specific) with accessories	01
2	Dedicated Computer Design Work Station	1 per trainee
3	Ultrasonic Cleaner	1 per trainee
4	UV-Curing Unit	1 per trainee
5	Weighing Scale Machine (0-50 gm)	1 per trainee
6	Air Blower (with regulator and nozzle	1 per trainee
7	Personal protective equipment	1 per trainee
8	Licensed Operating system	1 per trainee
9	Licensed CAM Software	1 per trainee
10	Digital Vernier Caliper	1 per trainee
11	Steel Rule	1 per trainee

List of Consumables for Jewellery CAM

Sr#	Name of Item/ Equipment/ Tools
1	Magnifying Glass/ Eye Loop/ Glass Optimizer Head Band
2	Spatulas
3	Thin paper Card/ Scrapper
4	Surgical Knife with handle
5	Surgical Scissors
6	Tissue Papers
7	Latex Gloves
8	Safety Goggles
9	3D Printing Resin(s)
10	Containers/Beakers
11	Washing/ Cleaning Solvent (according to 3D Printing Resin Family)
12	Sieve
13	Mask

14	Fine Sand Paper
15	Tooth Brush(Soft)
16	Magnifying Glass/ Eye Loop/ Glass Optimizer Head Band
17	
18	
19	
20	

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