THE REPUBLIC OF UGANDA
Ministry of Education and Sports

Business, Technical, Vocational Education and Training [BTVET]
Subsector Reform

Assessment and Training Package For BIOMEDICAL TECHNOLOGIST

Qualification Level: 1

Occupational Cluster: Physics, Technology and Design

January 2022

Developed by:

Directorate of Industrial Training
Qualifications Standards Department

Supported by:

Government of Uganda

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Under BTVET Act, 2008 the functions of the Directorate of Industrial Training are:

(a) To identify the needs of the labour market for occupational competencies that fall under the UVQF;
(b) To regulate apprenticeship schemes;
(c) To foster and promote entrepreneurial values and skills, as an integral part of the UVQF;
(d) To secure adequate and sustainable financing for the efficient operations of the Directorate;
(e) To accredit training institutions or companies as assessment centres;
(f) To determine fees payable under the Act;
(g) To develop, apply, expand and improve the purposeful application of Uganda Vocational Qualifications defined in the UVQF;
(h) To assess and award Uganda Vocational Qualifications;
(i) To promote on-the-job training in industry for apprenticeship, traineeship and indenture training and for other training such as further skills training and upgrading; and
(j) To prescribe the procedure for the making of training schemes

Further to the above provisions, there is an established Uganda Vocational Qualifications Framework (UVQF), under part V of the BTVET Act, 2008. It is stated that:

The purpose of the UVQF is to define:
(a) Occupational standards in the world of work;
(b) Assessment standards;
(c) Vocational qualifications of learners who meet the set standards of different studies;
(d) Provide guidelines for modular training.

The UVQF shall follow principles of Competence Based Education and Training (CBET) which include:
(a) Flexible training or learning modules;
(b) Positive assessment and Certification;
(c) Assessment of Prior Learning;
(d) Recognition of formal and non-formal training;
(e) Self-paced or individual learning and
(f) Work place learning

For award and recognition of certificates, the BTVET Act, 2008 provides that:

(1) The Directorate and other examination boards established under the Act shall award certificates and diplomas for Business, Technical or Vocational education and training under the UVQF;

(2) The Certificates and Diplomas to be awarded shall be in the form prescribed by the Minister on the recommendation of the Industrial Training Council;

(3) The Certificates and Diplomas awarded under the Act shall be recognized in the Uganda education system and by the labour market.

Under the TVET Implementation Standards 2020, the proposed new mandate of the Directorate of Industrial Training shall be restricted to promoting the highest standards in the quality and efficiency of industrial training in the country and ensuring an adequate supply of properly trained manpower at all levels in the industry and the world of work.

The functions shall include:

a) Regulating Industrial training and trainers,
b) Developing industrial training curricula,
c) Harmonizing curricula and certificates of competence,
d) Assessing industrial training,
e) Development of occupational standards and Assessment and Training Packages (ATPs) for Trade Testing for the industry and world of work and
f) Awarding certificates in that respect

At operational level in the Directorate, the Qualification Standards Department performs development tasks related to concepts, procedures and instruments for establishment of the UVQF in close collaboration with both public and private stakeholders in vocational training.

In particular, the Department organizes and coordinates the development of Assessment and Training Packages for use in competence-based vocational training as well as standards-based assessment and certification.

The Directorate has therefore produced this Assessment and Training Package for use in implementing Competence-Based Education and Training mechanisms.

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Word from Permanent Secretary

The Kajubi report (1989) and the Uganda Government White Paper on Education Review (1992) emphasized that the Uganda Secondary School Education should be vocationalised.

The World Bank Report on education in Uganda 2007 observed that although Uganda was experiencing steady economic growth on one hand, the secondary education curriculum was inadequately addressing the social and economic needs of the country on the other. The report further noted that it is not the very top academic cadres that contribute most to the growth of the GDP but rather the competent middle level technicians that are flexible and technologically literate that the economy needs in the labour force at all levels.

Correspondingly, the NDP III 2020/21- 2024/5 highlights (i) low labour productivity ;(ii) high youth unemployment (38%) and (iii) low transition rates from training to employment (35%) as some of the key challenges to Human Capital Development in Uganda.

In order to overcome these challenges, NDP III 2020/21- 2024/5, under objective 2 peaks the need to train the students for the urgently needed skills and mainstream a dual education and training system. This paved way for the development of the lower secondary school vocational curriculum which supports both academic and vocational training.

The afore is in line with the Uganda Vision 2040 under section 261 emphasizes that students will be accorded opportunities to excel in the skills areas they are placed into. These will range from sports and cut to technical and vocational training. Hitherto, section 262 clearly states that the entire education system will be changed to emphasize practical skills, attitude and moral values.

Government of Uganda through the Ministry of Education and Sports rolled out the lower secondary school education curriculum in secondary schools countrywide during the first term of the academic year 2020. The overall goal of this curriculum is to produce graduates with employable skills and who are competitive in the labour market. It should be emphasized that vocational training will produce graduates who are employable. In the lower secondary school vocational curriculum emphasis will be on equipping learners with employable skills and competencies. This will enable learner's perform the requisite duties of the specified occupations. This is the reason why the lower secondary school vocational curriculum was tailored to the assessment requirements of the World of work

Reading from the curriculum Framework page 12 it is stated that the learners will be assessed by DIT. Upon assessment and certification, the graduates will be employable and competitive in the labour market it's against this background that DIT, within its mandate vested in the BTVET Act 2008 comes on board to take the lead in the development of the requisite Assessment and Training Packages for the various occupations that will be assessed under the Lower Secondary Curriculum.

The ATP can be used by any training provider and/or those who wish to present themselves for Occupational Assessment and Certification.

Herewith, the Directorate of Industrial Training presents the reviewed "Assessment & Training Package (ATP)" for training, assessment and certification of a **BIOMEDICAL TECHNOLOGIST - QUALIFICATION LEVEL 1.**

Finally, I thank all individuals and organizations who have contributed and/or participated in the review of this noble document.

Ketty Lamaro
Permanent Secretary

Executive Summary

This Assessment and Training Package is a Competence-Based Education and Training (CBET) tool and consists of three major parts:

0.1 PART I: The "Occupational Profile" (OP) of a BIOMEDICAL TECHNOLOGIST
This Occupational Profile which was developed by Biomedical Technologists practicing in the world of work, mirrors the duties and tasks Biomedical Technologists are expected to perform in the world of work.

0.2 PART II: "Training Modules" in the form of guidelines to train **BIOMEDICAL TECHNOLOGIST** both on the job as well as in training centres (or combinations of both venues of learning). The Training Modules herein have been developed basing on the Occupational Profile and hence are directly relevant for employment.

0.3 PART III: "Assessment Instruments" in the form of performance (Practical) and written (theory) test items that can and should be used to assess whether a person complies with the requirements of employment as a **Biomedical Technologist**. These assessment instruments were developed jointly by job practitioners (BIOMEDICAL TECHNOLOGISTS) and teachers based on the occupational profile and training modules[1].

0.4 While the Occupational Profile (OP) contained in PART I of this document provides the information on **WHAT a person is expected to do** competently in the world of work, the test items, -including performance criteria- of PART III qualify the **HOW and/or HOW WELL a person must do the job**.

0.5 The modular format of the curriculum (PART II) allows learners to acquire job specific skills and knowledge (i.e. competencies) module by module. A single module can be accomplished within a relatively short duration of time allowing flexibility for learners to move directly into an entry level job, go for further modules or advance to higher levels of training. Modular courses allow more learners to access the training system because training centres as well as companies can accommodate more students in a given period of time.

0.6 In addition to improved access, equity and relevance of BTVET, the UVQF will also enable people who are convinced to have acquired competencies laid down in this ATP through prior training and on-the-job experience to access assessment and certification directly; be it on the basis of a single module, a group of modules or all modules pertaining to the occupation at once. This achievement will facilitate Recognition of Prior Learning (RPL).

[1]In this document, only sample test items for assessing (practical) performance and occupational knowledge (theory) are included. A larger selection of test items can be obtained from an electronic Test Item Bank at Directorate of Industrial Training

0.7 The parts of this Assessment and Training Package were sequentially developed as follows:

i Part 1: Occupational Profile: ***January 2022***
ii Part 2: Training Modules: ***January 2022***
iii Part 3: Assessment Instruments (initial bank): ***January 2022***

This ATP (or parts of it) may be periodically revised to match the dynamic trends in the occupation and hence issued in different versions.

Mr. Byakatonda Patrick
Ag. Director DIT

Acknowledgement

The Qualifications Standards Department of DIT wishes to sincerely acknowledge the valuable contributions to the development of this Assessment and Training Package by the following persons, Institutions and organizations:

- Members of the DIT Industrial Training Council;
- The Director and staff of DIT;
- Ministry of Education and Sports;
- The practitioners from the world of work;
- Teachers of Physics, Chemistry and Biology in various secondary schools
- Physics, Technology and Design curriculum specialist from NCDC
- Examination Specialist from UNEB
- The facilitators involved in guiding the development panels in their activities;
- The Government of Uganda for financing the development of this ATP;

Abbreviations and acronyms

A&C	Assessment & Certification
ATP	Assessment & Training Packages
BTVET	Business, Technical and Vocational Education and Training
CBET	Competency Based Education and Training
DIT	Directorate of Industrial Training
ITC	Industrial Training Council
GoU	Government of Uganda
LWA	Learning-working Assignment
MC	Modular Curriculum
MoES	Ministry of Education and Sports
OP	Occupational Profile
PEX	Practical Exercise
PTI	Performance (Practical) Test Item
QS	Qualification Standards
RPL	Recognition of Prior Learning
TIB	Test Item Bank
TVET	Technical, Vocational Education and Training
UVQ	Uganda Vocational Qualification
UVQF	Uganda Vocational Qualifications Framework
WTI	Written (Theory) Test Item

Key definitions

Assessment	Assessment is the means by which evidence is gathered and judged to decide if an individual has met the stipulated assessment standards or not. Testing is a form of formal assessment.
Certification	Certification is a formal procedure to issue a certificate (qualification) to an individual that has demonstrated during formal assessment that he/she is competent to perform the tasks specified in the occupational profile.
Competence	Integration of skills, knowledge, attitudes, attributes and expertise in doing /performing tasks in the world of work to a set standard.
Competency	(Occupational) competency is understood as the ability to perform tasks common to an occupation to a set standard.
CBET	Competence-Based Education and Training means that programs: 1. have content directly related to work 2. focus is on 'doing something well' 3. assessment is based upon industry work standards, and 4. curricula are developed in modular form
Duty	A duty describes a large area of work in performance terms. A duty serves as a title for a cluster of related Tasks (see also: TASK).
Learning-Working Assignment (LWA)	LWAs are simulated or real job situations / assignments that are suitable for learning in a training environment (e.g. "small projects"). In a working environment, LWAs are real work situations/assignments.
Module	Modules are part(s) of a whole curriculum. Modules can be considered as "self-contained" partial qualifications which are described by learning outcomes or competencies and which can be assessed and certified individually.
Occupational Profile (OP)	An Occupational Profile is an overview of the duties and tasks a job incumbent is expected to perform competently in employment. Occupational Profiles developed by practitioners from the world of work enhance the relevance of training and learning to the requirements of the world of work.

	Occupational Profiles define WHAT a person is supposed to do in performance terms. They also contain generic information regarding related knowledge and skills, attitudes/behavior, tools, materials and equipment required to perform as well as trends/ concerns in the occupation. Occupational profiles are the reference points for developing modular curricular and assessment standards
Qualification	A qualification is a formal recognition for demonstrating competence, based on formal assessment against set standards. A qualification is provided to the individual in form of a certificate specifying the nature of the competence.
Practical Exercise (PEX)	PEXs are practical exercises that are suitable for learning in a training environment
Task	Job TASKS represent the smallest unit of job activities with a meaningful outcome. Tasks result in goods, service, or decision. They represent an assignable unit of work and have a definite beginning and ending point. Tasks can be observed and measured. *(see also: Duty)*

1.0 ATP-PART I

Occupational Profile for A BIOMEDICAL TECHNOLOGIST

1.1 The OCCUPATIONAL PROFILE (OP) for "Biomedical Technologist" below defines the ***Duties*** and ***Tasks*** a competent Biomedical Technologist is expected to perform in the world of work (on the job) in Uganda and the East African region today.

1.2 Since it reflects the skill requirements of work life, the Occupational Profile is the reference document for the subsequent development of training modules and assessment instruments (test items) which are directly relevant to employment in Ugandan and the East African businesses and industries.

1.3 To ensure that the Occupational Profile is relevant for employment in Uganda and East Africa, the DIT used the method of "occupational/job profiling.[1]

1.4 This approach involves the brainstorming of a panel of 8 to 12 competent job practitioners guided by trained and experienced facilitators. During a two-day workshop the panelists define the duties and tasks performed in employment, as well as the prerequisite skills, knowledge, attitudes, tools and equipment, and the future trends and concerns in the occupation/job.

1.5 The panelists, facilitators and coordinators who participated in developing this Occupational Profile for a BIOMEDICAL TECHNOLOGIST are listed on the following page.

'The DACUM-method was used. DACUM is an acronym for 'Develop A Curriculum'

Job Expert Panel

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Ministry of Education And Sports

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NCDC

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Opira Benson
Sacred Heart SS Girls School - Gulu

Mutiibwa Francis Emmanuel
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Paul Butono
Busoga College Mwiri

Amiri Lukung
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Priscilla Kemigisha
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St Francis Hospital Nsambya

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Funded by
The Government of Uganda

THE REPUBLIC OF UGANDA

Ministry of Education and Sports

Business, Technical and Vocational

Education and Training (BTVET) Sub sector Reform

Occupational Profile

of a "Biomedical Technologist"

Developed by: Qualifications standards Department of Directorate of Industrial Traini

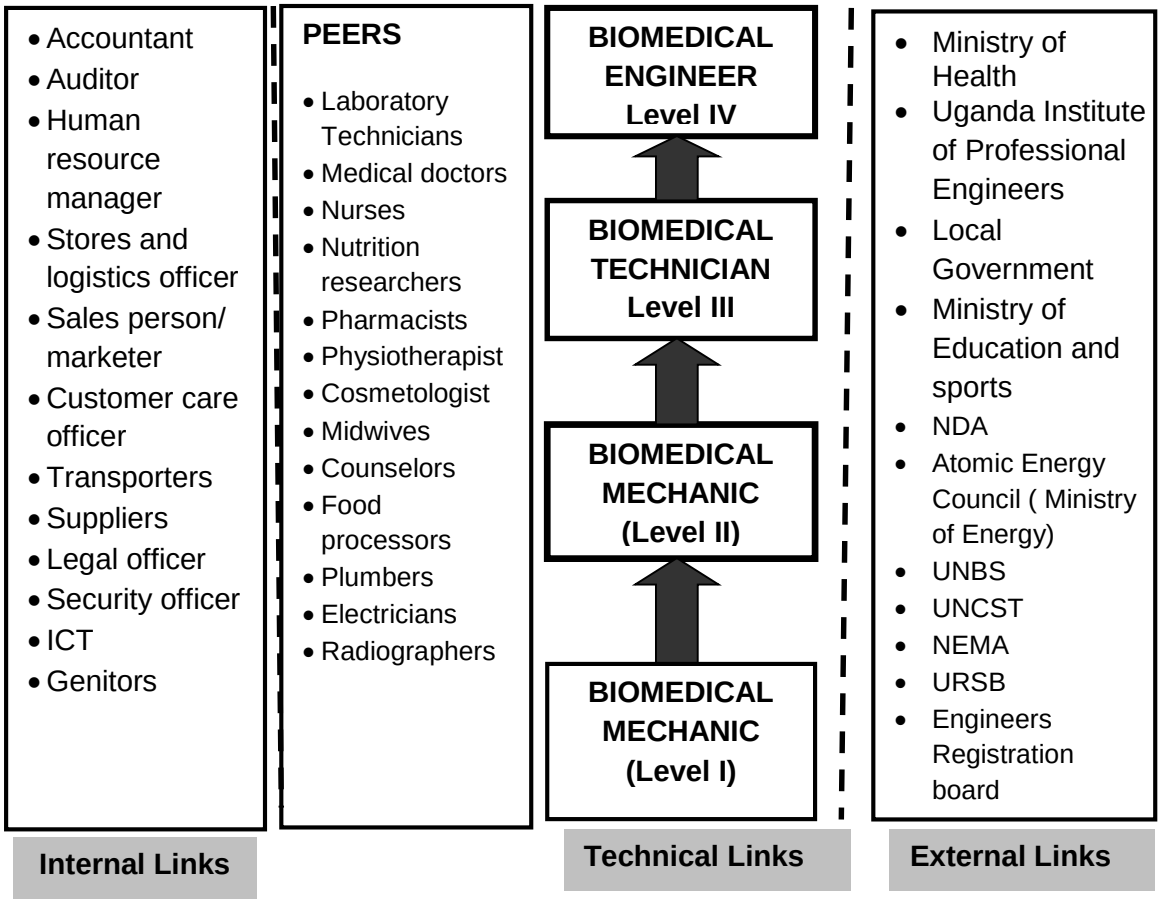
Dates of workshop:

17th – 21st January2022

NOMENCLATURE FOR THE OCCUPATION OF BIOMEDICAL TECHNOLOGIST

Definition: Is the person who applies engineering principles, practices, technologies in the field of medicine or biology in improving and solving health care challenges

JOB ORGANIZATION CHART FOR A BIOMEDICAL TECHNOLOGISTS



Descriptions for the levels in the occupation of 'Biomedical Technologist'

UVQ BIOMEDICAL MECHANIC (Level I): Is a person who can install, service and repair class I biomedical equipment.

UVQ BIOMEDICAL MECHANIC (Level II): Is a person who can install, service and repair class II A biomedical equipment

UVQ BIOMEDICAL TECHNICIAN (Level III): is a person who can install, service and repair class II B biomedical equipment

UVQ BIOMEDICAL ENGINEER (Level IV): Is a person who can install, service, repair class III biomedical equipment and manage biomedical equipment activities

Duties and Tasks

A. PLAN MECHANICAL WORK	**A1** Prepare work schedules	**A2** Identify service providers	**A3** Assign roles
	A4 Conduct feasibility study	**A5** Prepare location and site	**A6** Mobilize tools and materials
	A7 Develop performance indicators	**A8** Review project work	

B. ESTABLISH BIOMEDICAL ENTERPRISE	**B1** Select site	**B2** Secure site	**B3** Develop business plan
	B4 Source funds	**B5** Register entreprise	**B6** Procure materials, tools and equipment
	B7 Perform market survey	**B8** Insure enterprise	**B9** Partner with peers
	B10 Market biomedical products and services	**B11** Perform customer care services	

C. PERFORM OCCUPATIONAL HEALTH AND SAFETY	**C1** Wear protective gears	**C2** Perform fire fighting	**C3** Administer First Aid
	C4 Develop safety guidelines	**C5** Maintain personal hygiene	**C6** Sensitize workers on safety issues
	C7 Manage waste	**C8** Store hazardous materials	**C9** Label equipment and materials
	C10 Display safety signs	**C11** Sanitize tools and equipment	**C12** Set up health and safety committees

D. INSTALL BIOMEDICAL EQUIPMENT	**D1** Develop installation schedule	**D2** Select tools and materials	**D3** Prepare installation station
	D4 Assemble equipment	**D5** Mount equipment	**D6** Perform equipment functional test

E. MAINTAIN BIOMEDICAL EQUIPMENT	**E1** Perform equipment inventory	**E2** Develop maintenance plan	**E3** Open equipment
	E4 Check equipment defaults	**E5** Check equipment components	**E6** Lubricate equipment parts
	E7 Replace equipment parts	**E8** Calibrate medical equipment	**E9** Clean equipment
	E10 Keep maintenance records		

F. REPAIR BIOMEDICAL EQUIPMENT	**F1** Inspect biomedical equipment	**F2** Troubleshoot medical equipment	**F3** Perform circuit analysis test
	F4 Replace faulty equipment parts	**F5** Perform software upgrade	**F6** Perform electrical safety test
	F7 Prepare job card		

G. PERFORM CAPACITY BUIDING	**G1** Develop training manuals	**G2** Attend technical training /workshop	**G3** Perform hands on user training
	G4 Attend industrial training	**G5** Carryout exchange program	**G6** Conduct refresher training
	G7 Mentor workers and trainees	**G8** Orient workers and trainees	

H. PERFORM ADMINISTRATIVE TASKS	**H1** Prepare equipment reports	**H2** Supervise workers	**H3** Prepare budgets
	H4 Perform inventory	**H5** Recruit workers	**H6** Mentor workers
	H7 Appraise workers	**H8** Assign works	**H9** Remunerate workers
	H10 Insure workers		

Additional Information

Related knowledge & skills

1. Interprete equipment manual
2. Interprete service manual
3. Identify right tools and materials
4. Communication skills
5. Interpersonal skills
6. Literacy and numeracy
7. Use of basic components eg capacitors, resistors, transistors
8. Physics, biology, chemistry and medicine
9. Use of design programs like auto cards and arch card
10. Principles of equipment operation and servicing
11. Testing products, equipment and devices
12. Modify products equipment and devices
13. Research skills
14. ICT
15. Leadership skills
16. Planning skills
17. Report writing and documentation
18. Training skills
19. Components of safety gears
20. Financial management skills
21. Waste management
22. Store management
23. Designing and fabricating machines
24. Collaboration and team effort skills
25. Interpreting error codes
26. Installation skills
27. Analytical skills
28. Troubleshooting skills
29. Entrepreneurship and management skills

Tools, Equipment and Materials

1. Multimeter
2. Screw drivers
3. Tester
4. Pair of pliers
5. Wire stripper
6. Safety analyzers
7. Soldering gun
8. Cathode ray oscilloscope
9. Wrench
10. Heavy duty gloves
11. Spectrum analyzer
12. Magnetometer
13. Signal generators
14. Protective gears (goggles, masks etc)
15. Hot air gun
16. Blower
17. Oxygen analyser
18. Allens keys
19. Torgues
20. Microscope
21. Urine analyser
22. Pipettes
23. Autoclaves
24. ESR analyser
25. ECG machine
26. Anaethesia machine
27. Hematology analyser
28. Electrical tape
29. Drilling machine
30. Ventilators
31. Pulse oximeter
32. High speed centrifuge
33. Thermometer
34. Patient monitors
35. Defibrillator
36. Ultrasound machine
37. Stethoscope
38. Dental machines
39. WD-40
40. Reagents
41. Hospital stretcher
42. Sono paper
43. Aspiration/Suction
44. Pump
45. Autoclave / Sterilizer
46. Blood Chemistry analyzer
47. C-Arm system – unit, monitor, table
48. Cast Saw
49. Centrifuge
50. Coagulation analyzer
51. Colposcopy Equipment
52. Computers
53. CPAP/Humidifier
54. Dermatome
55. Diagnostic Ultrasound with probes
56. ECG/EKG
57. Electrosurgical Unit
58. Endoscopy system – scope, insufflator, light source etc
59. Exam Light and table
60. Feeding Pump
61. Fetal Doppler
62. Fetal Monitor
63. Hospital Bed
64. Infant Incubator
65. Infant Warmer
66. Infusion Pump
67. IV Pole
68. Lab Equipment – incubator, shaker, washer, scale
69. Lab Microscope
70. Lab Refrigerator
71. Laryngoscope
72. Nebulizer
73. Ophthalmic Equipment – slit lamp, surgical scope
74. Ophthalmoscope
75. Oxygen Concentrator
76. Oxygen Cylinder and Regulator
77. Bipaps machine
78. Refrigerator
79. Drill
80. Vaccum extractor
81. Patient Scale – adult and infant
82. Patient Warmer
83. Portable Glucose Monitor
84. Pulse Oximeter
85. Sequential Compression Device
86. Sphygmomanometer – aneroid and digital Stethoscope
87. Surgical Headlamp
88. Surgical Light Head – ceiling mounted and portable
89. Surgical Microscope
90. Surgical Table – surgical and delivery
91. Thermometer
92. Traction Unit
93. Vital Sign Monitor
94. Wheelchair
95. X-Ray equipment – portable, dental, mammography
96. X-ray view box
97. Dialysis machine
98. Audiometer
99. Electrosurgical units
100. Capnometer
101. Phototherapy machine
102. Seven segment display
103. Liquid crystal display
104. Spectrophotometer
105. Integrated circuits
106. Diodes
107. Fuse
108. Bench vice (for clamping)
109. Sunction machines
110. Test tubes, beakers, slides
111. Boilers
112. Bunsen burners
113. Fetoscope
114. Voltage stabilizers

Attitudes / Traits / Behavior

1. Honest
2. Trust worthy
3. Hardworking
4. Creativity
5. Cooperative
6. Quick decision maker
7. Self-driven
8. Faithful
9. Time conscious
10. Committed
11. Respectful
12. Good listener
13. Trainable
14. Team player
15. Result orientable
16. Patient
17. Careful
18. Humorous
19. Courageous
20. Perseverance
21. Disciplined
22. Economical
23. Social
24. Innovative
25. Developmental
26. Professional

Future Trends and Concerns

1. Unavailable spare parts
2. Advancement in technology
3. Counterfeits products on the market
4. Lack of regulations or policies in biomedical practice
5. Unskilled practitioners in the biomedical field (impersonators)
6. High taxation on biomedical products
7. Popularization of the profession
8. Inadequate institutional structures
9. Substandard equipment donations
10. Training of the procurement officers of biomedical equipment
11. Outdated medical equipment policy
12. No recognized association for biomedical engineers

2.0 ATP – PART II
Training Modules for a BIOMEDICAL TECHNOLOGIST

2.1 A curriculum is a "guide /plan for teaching and learning" which provides a guide to teachers, instructors and learners. In the envisaged system of competence-based or outcome-oriented education and training (CBET), Curricula are no longer the benchmark against which assessment is conducted. It is rather the Occupational Profile that provides the benchmark for Curriculum development as well as assessment.

2.2 This modular format of the curriculum allows learners of the **Biomedical Technologist** occupation to acquire job specific skills and knowledge (i.e. competencies) module by module. A single module can be accomplished within a relatively short duration of time allowing learners to move directly into an entry level job, do further modules and advance to higher levels of training. Modular courses allow more learners to access the training system because training centres, as well as companies can accommodate more students in a given period of time.

2.3 The modules were developed jointly by both instructors and job practitioners. They were developed using the Occupational Profile as a reference point and taking into account the specifications of training and learning outcomes.

2.4 The modules contain "Learning-Working Assignments" (LWAs) and related "Practical Exercises" (PEXs) as key elements.

LWAs are simulated or real job situations/assignments that are suitable for learning in a training environment (e.g. "small projects"). In a working environment, LWAs are real work situations.

PEXs are therefore sub-sets of a LWA.

2.5 In principle, and following the philosophy of Competence-Based Education and Training (CBET), the modules can be used as a guide for learning in a training Centre, at the workplace; or a combination of both.

UVQF LEVELS 1- 3 QUALIFICATION DESCRIPTORS

In the Uganda Vocational Qualifications Framework, persons with qualifications **Levels1, 2 and 3** are understood as **IMPLEMENTERS** in an occupation**.**

Level 1 Qualification shall mean that the individual is a **Semi-Skilled Implementer;**

Level 2 Qualification shall mean that the individual is a **Skilled Implementer;**

Level 3 Qualification shall mean that the individual is a **Highly Skilled Implementer (Working Supervisor).**

The qualification descriptors for Levels 1 – 3 are described as follows:

	Dimension of qualification	**Level1: Descriptor**	**Level2: Descriptor**	**Level3: Descriptor**
1.	**Scope of work** (duties and tasks)	Narrow range	Moderate range	Broad range
2.	**Work environment and context**	Uniform	Some variety	Variety
3.	**Complexity of tasks** (work sequence)	Simple	Sometimes complex	Complex
4.	**Predictability of tasks**	Routine tasks	Non-routine tasks	Occasionally unpredictable
5.	**Teamwork**	Usually works in a team	Works in a team with some autonomy	Works with teams
6.	**Leadership**	None	Intermediate Supervisor of subordinates	Supervisor of subordinates
7.	**Autonomy (Supervision)**	Under direct supervision	Under supervision by superiors	Some autonomy but checked on results by superiors
8.	**Financial and physical Resources control**	None	Limited control	Moderate control
9.	**Creation of concepts and solutions**	None	None	None but may make proposals

WHO IS A BIOMEDICAL TECHNOLOGIST QUALIFICATION LEVEL 1

Is a person who can install, service and repair class I biomedical equipment.

OVERVIEW OF TRAINING MODULES FOR A BIOMEDICAL TECHNOLOGIST LEVEL I

Code	Module Title	Average duration	
		Contact hours	Weeks
UE/BMT/M1.1	Install Biomedical Equipment	480	12
UE/BMT/M1.2	Maintain Biomedical Equipment	672	17
UE/BMT/M1.3	Repair Biomedical Equipment	1200	30
UE/BMT/M1.4	Perform Entrepreneurship skills	240	6
Summary	**Training Modules**	**2592 hours**	**65 weeks**

Note: Average duration is contact time but NOT calendar duration

It is assumed that:

- 1 day is equivalent to 8 hours of nominal learning and
- 1 month is equivalent to 160hours of nominal learning

Information given on the average duration of training should be understood as a guideline. Quick learners may need less time than indicated or vice versa

At completion of a module, the learner should be able to satisfactorily perform the included Learning Working Assignments, their Practical exercises and attached theoretical instructions, as the minimum exposure.

Prior to summative assessment by recognized Agencies, the users of these Modules Guides are encouraged to carefully consider continuous assessment using samples of (or similar) performance (practical) and written test items available in part 3 of this ATP for a **BIOMEDICAL TECHNOLOGIST**

Code	UE/BMT/M1.1
Module title	**Install Biomedical Equipment**
Related Qualification	Part of Uganda Vocational Qualification (Biomedical Technologist UVQ 1)
Qualification Level	1
Module purpose	At the end of this module, the trainee will be able to install Class I biomedical equipment
Learning-Working Assignments (LWAs)	**LWA 1/1: Install Microscope** **LWA 1/2: Install Infusion pump** **LWA 1/3: Install Stethoscope** **LWA 1/4: Install Blood pressure machine** **LWA 1/5: Install Pulse oximeter** **LWA 1/6: Install Glucometer** **LWA 1/7: Install Weighing scale** **LWA 1/8: Install Roller mixer** **LWA 1/9: Install Water bath** **LWA 1/10: Install Hospital medical furniture** **LWA 1/11: Perform occupational health, safety and environmental protection practices (OHSEPP)** ***Note:*** *1. The learning exercises may be repeated till the Trainee acquires targeted competence;* *2. The Trainer is advised to deliver relevant theoretical instruction with demonstrations as required to perform each learning working assignment.*
Related Practical Exercises (PEXs)	**LWA 1/1: Install Microscope** PEX 1.1: Select tools and materials PEX 1.2: Assemble the microscope components PEX 1.3: Perform electrical test PEX 1.4: Perform functional test PEX 1.5: Write job card PEX 1.6: Clean equipment PEX 1.7: Conduct hands on user training

	LWA 1/2: Install Infusion pump PEX 2.1: Select tools and materials PEX 2.2: Assemble infusion pump components PEX 2.3: Perform electrical test PEX 2.4: Perform functional test PEX 2.5: Write job card PEX 2.6: Clean equipment PEX 2.7: Conduct hands on user training
	LWA 1/3: Install Stethoscope PEX 3.1: Select tools and materials PEX 3.2: Assemble stethoscope components PEX 3.3: Perform electrical test PEX 3.4: Perform functional test PEX 3.5: Write job card PEX 3.6: Clean equipment PEX 3.7: Conduct hands on user training
	LWA 1/4: Install Blood pressure machine PEX 4.1: Select tools and materials PEX 4.2: Assemble equipment components PEX 4.3: Perform electrical test PEX 4.4: Perform functional test PEX 4.5: Write job card PEX 4.6: Clean equipment PEX 4.7: Conduct hands on user training
	LWA 1/5: Install Pulse oximeter PEX 5.1: Select tools and materials PEX 5.2: Assemble pulse oximeter components PEX 5.3: Perform electrical test PEX 5.4: Perform functional test PEX 5.5: Write job card PEX 5.6: Clean equipment PEX 5.7: Conduct hands on user training
	LWA 1/6: Install Glucometer PEX 6.1: Select tools and materials PEX 6.2: Assemble glucometer components PEX 6.3: Perform electrical test PEX 6.4: Perform functional test

	PEX 6.5: Write job card PEX 6.6: Clean equipment PEX 6.7: Conduct hands on user training
	LWA1/7:Install Weighing scale PEX 7.1: Select tools and materials PEX 7.2: Assemble weighing scale components PEX 7.3: Perform electrical test PEX 7.4: Perform functional test PEX 7.5: Write job card PEX 7.6: Clean equipment PEX 7.7: Conduct hands on user training
	LWA 1/8: Install Roller mixer PEX 8.1: Select tools and materials PEX 8.2: Assemble roller mixer components PEX 8.3: Perform electrical test PEX 8.4: Perform functional test PEX 8.5: Write job card PEX 8.6: Clean equipment PEX 8.7: Conduct hands on user training
	LWA1/9:Install Water bath PEX 9.1: Select tools and materials PEX 9.2: Assemble water bath components PEX 9.3: Perform electrical test PEX 9.4: Perform functional test PEX 9.5: Write job card PEX 9.6: Clean equipment PEX 9.7: Conduct hands on user training
	LWA1/10:Install Hospital medical furniture PEX 10.1: Select tools and materials PEX 10.2: Assemble patient beds PEX 10.3: Assemble bedside lockers PEX 10.4: Assemble trolleys PEX 10.5: Assemble ward screens PEX 10.6: Assemble examination coaches PEX 10.7: Perform functional test PEX 10.8: Write job card PEX 10.9: Clean equipment PEX 10.10: Conduct hands on user training

	LWA 1/11: Perform occupational health, safety and environmental protection practices (OHSEPP) PEX 11.1: Clean workplace PEX 11.2: Wear protective gears PEX 11.3: Perform fire fighting PEX 11.4: Administer First Aid PEX 11.5: Manage waste PEX 11.6: Maintain personal hygiene PEX 11.7: Sanitize tools and equipment PEX 11.8: Display safety signs PEX 11.9: Label equipment PEX 11.10: Develop safety guidelines PEX 11.11: Store hazardous materials
Occupational health and safety	Precautions, rules and regulations on occupational health, safety and environmental protection, included in the listed related knowledge should be observed and demonstrated during LWAs and PEXs.
Pre-requisite modules	None
Related knowledge/ theory	*For Occupational theory suggested for instruction/ demonstration, the Trainer is not limited to the outline below. In any case, related knowledge/ theory may be obtained from various recognized reference materials as appropriate:* • How to commission and assemble different medical equipment • Working in a well-ventilated environment • Types of hazardous materials and how to store them • How to write a job card • How to conduct hands on user training • How to perform an electrical safety test and equipment functional test • How to write a safety and health assessment report • How to take equipment inventory • How to write a detailed report about installation • How to interpret installation manual • Tools and materials used in installation • ICT • Communication skills

Average duration of learning	*480 hours (60 days) of nominal learning suggested to include:* • *20 days of occupational theory and* • *40 days of occupational practice*
Occupational health and safety	Precautions, rules and regulations on occupational health, safety and environmental protection, included in the listed related knowledge should be observed and demonstrated during LWAs and PEXs.
Pre-requisite modules	None
Suggestions on organization of learning	The acquisition of competencies (skills, knowledge, attitudes) described in this module may take place at a training centre or its equivalent provided all equipment and materials required for training are in place.
Assessment	Assessment to be conducted according to established regulations by recognized assessment body using related Practical and Written Test Items from Item Bank
Minimum required tools/ equipment/ implements or equivalent	Microscope, infusion pump, blood pressure machine, pulse oximeter, roller mixer, water bath, glucometer, weighing scale, stethoscope, patient beds, trolleys, bedside lockers, examination coaches, ward screens, screw drivers, tester, multimeter, torques, wrench, hand drill, adjustable spanner, pair of pliers, wire cutters, wire strippers, allen keys, electrical safety tester, blower, brooms, squeezers, moppers, soldering gun, protective gears
Minimum required materials and consumables or equivalent	Lubrication materials – WD 40, grease (hospital furniture), gauze, cotton, lens cleaner, 70% ethanol, water, liquid soap, towels, scourer, drilling bits, soldering wire
Special notes	Its best to purchase an electrical and mechanical tool kit because it has all the listed tools Theory should be taught at the same time with practicals

Code	UE/BMT/M1.2
Module title	**M1.2: Maintain Biomedical Equipment**
Related Qualification	Part of Uganda Vocational Qualification (Biomedical Technologist UVQ 1)
Qualification Level	1
Module purpose	At the end of this module, a trainee will be able to maintain Class I biomedical equipment
Learning-Working Assignments (LWAs)	**LWA 2/1: Service Microscope** **LWA 2/2: Service Infusion pump** **LWA 2/3: Maintain Stethoscope** **LWA 2/4: Service Blood Pressure machine** **LWA 2/5: Service Pulse oximeter** **LWA 2/6: Service Glucometer** **LWA 2/7: Service Weighing scale** **LWA 2/8: Service Roller mixer** **LWA 2/9: Service Water bath** **LWA 2/10: Service Hospital medical furniture** **LWA 2/11: Perform occupational health, safety and environmental protection practices (OHSEPP)** ***Note:*** *1. The learning exercises may be repeated till the Trainee acquires targeted competence;* *2. The Trainer is advised to deliver relevant theoretical instruction with demonstrations as required to perform each learning working assignment.*
Related Practical Exercises (PEXs)	**LWA 2/1: Service Microscope** PEX 1.1: Perform equipment inventory PEX 1.2: Select tools and materials PEX 1.3: Inspect equipment PEX 1.4: Review equipment service history PEX 1.5: Lubricate stage, coarse and fine adjustment PEX 1.6: Clean lenses PEX 1.7: Clean external parts of a microscope PEX 1.8: Check lighting system (bulb) PEX 1.9: Re-align mirrors

	PEX 1.10: Replace worn out parts PEX 1.11: Perform electrical safety test PEX 1.12: Perform equipment functional test PEX 1.13: Write job card
	LWA 2/2: Service Infusion pump PEX 2.1: Perform equipment inventory PEX 2.2: Select tools and materials PEX 2.3: Inspect equipment PEX 2.4: Review equipment service history PEX 2.5: Clean equipment PEX 2.6: Lubricate pump PEX 2.7: Replace worn out equipment parts PEX 2.8: Calibrate equipment PEX 2.9: Perform electrical safety test PEX 2.10: Perform functional test PEX 2.11: Write job card
	LWA 2/3: Maintain Stethoscope PEX 3.1: Perform equipment inventory PEX 3.2: Select tools and materials PEX 3.3: Inspect equipment PEX 3.4: Review equipment service history PEX 3.5: Clean equipment PEX 3.6: Replace worn out equipment parts PEX 3.7: Perform functional test PEX 3.8: Write job card
	LWA 2/4: Service Blood pressure machine PEX 4.1: Perform equipment inventory PEX 4.2: Select tools and materials PEX 4.3: Inspect equipment PEX 4.4: Review equipment service history PEX 4.5: Clean equipment PEX 4.6: Replace worn out equipment parts PEX 4.7: Refill mercury PEX 4.8: Replace batteries PEX 4.9: Calibrate equipment PEX 4.10: Perform electrical safety test PEX 4.11: Perform functional test PEX 4.12: Write job card

	LWA 2/5: Service Pulse oximeter PEX 5.1: Perform equipment inventory PEX 5.2: Select tools and materials PEX 5.3: Inspect equipment PEX 5.4: Review equipment service history PEX 5.5: Clean equipment PEX 5.6: Replace worn out equipment parts PEX 5.7: Replace batteries PEX 5.8: Perform electrical safety test PEX 5.9: Perform functional test PEX 5.10: Write job card
	LWA 2/6: Service Glucometer PEX 6.1: Perform equipment inventory PEX 6.2: Select tools and materials PEX 6.3: Inspect equipment PEX 6.4: Review equipment service history PEX 6.5: Clean equipment PEX 6.6: Replace worn out equipment parts PEX 6.7: Calibrate equipment PEX 6.8: Replace batteries PEX 6.9: Perform electrical safety test PEX 6.10: Perform functional test PEX 6.11: Write job card
	LWA 2/7: Service Weighing scale PEX 7.1: Perform equipment inventory PEX 7.2: Select tools and materials PEX 7.3: Inspect equipment PEX 7.4: Review equipment service history PEX 7.5: Clean equipment PEX 7.6: Replace worn out equipment parts PEX 7.7: Lubricate equipment PEX 7.8: Calibrate equipment PEX 7.9: Replace batteries PEX 7.10: Perform functional test PEX 7.11: Write job card

	LWA 2/8: Service Roller mixer PEX 8.1: Perform equipment inventory PEX 8.2: Select tools and materials PEX 8.3: Inspect equipment PEX 8.4: Review equipment service history PEX 8.5: Clean equipment PEX 8.6: Replace worn out equipment parts PEX 8.7: Lubricate rollers and motor membranes PEX 8.8: Adjust roller speed PEX 8.9: Perform electrical safety test PEX 8.10: Perform functional test PEX 8.11: Write job card
	LWA 2/9: Service Water bath PEX 9.1: Perform equipment inventory PEX 9.2: Select tools and materials PEX 9.3: Inspect equipment PEX 9.4: Review equipment service history PEX 9.5: Clean equipment PEX 9.6: Replace faulty equipment parts PEX 9.7: Perform electrical safety test PEX 9.8: Perform functional test PEX 9.9: Write job card
	LWA 2/10: Service Hospital medical furniture PEX 10.1: Perform equipment inventory PEX 10.2: Select tools and materials PEX 10.3: Inspect equipment PEX 10.4: Review equipment service history PEX 10.5: Clean equipment PEX 10.6: Lubricate equipment PEX 10.7: Replace faulty equipment parts PEX 10.8: Perform electrical safety test PEX 10.9: Perform functional test PEX 10.10: Write job card

	LWA 2/11: Perform Occupational health, safety and environmental protection practices(OHSEPP) PEX 11.1: Wear protective gear PEX 11.2: Administer First Aid PEX 11.3: Perform fire fighting PEX 11.4: Manage waste PEX 11.5: Maintain personal hygiene PEX 11.6: Develop safety guidelines PEX 11.7: Store hazardous materials PEX 11.8: Sanitize tools and equipment PEX 11.9: Display safety signs PEX 11.10: Label equipment
Occupational health and safety	Precautions, rules and regulations on occupational health, safety and environmental protection, included in the listed related knowledge should be observed and demonstrated during LWAs and PEXs.
Pre-requisite modules	None
Related knowledge/ theory	*For Occupational theory suggested for instruction/ demonstration, the Trainer is not limited to the outline below. In any case, related knowledge/ theory may be obtained from various recognized reference materials as appropriate:* • Proper ventilation during servicing • How to write an equipment inventory • How to identify worn out and faulty equipment parts • How to conduct a functional and electrical safety test • How to conduct an equipment functional test • Selection of tools and materials to be used • How to clean and lubricate the equipment • Waste management • How to write a job card • ICT • Communication skills and Record keeping • Analytical skills • Environmental and protection • Operation and maintenance principles of different biomedical equipment

Average duration of learning	672 hours (84 days) of nominal learning suggested to include: • *56 days of occupational theory and* • *28 days of occupational practice*
Suggestions on organization of learning	The acquisition of competencies (skills, knowledge, attitudes) described in this module may take place at a training centre or its equivalent provided all equipment and materials required for training are in place.
Assessment	Assessment to be conducted according to established regulations by recognized assessment body using related Practical and Written Test Items from Item Bank
Minimum required tools/ equipment/ implements or equivalent	Microscope, infusion pump, blood pressure machine, pulse oximeter, roller mixer, water bath, glucometer, weighing scale, stethoscope, patient beds, trolleys, bedside lockers, examination coaches, ward screens, screw drivers, tester, multimeter, torques, wrench, hand drill, adjustable spanner, pair of pliers, wire cutters, wire strippers, allen keys, electrical safety tester, blower, brooms, squeezers, moppers, soldering gun, protective gears
Minimum required materials and consumables or equivalent	Pens, pencils, notebook, Lubrication materials – WD 40, grease (hospital furniture), gauze, cotton, lens cleaner, 70% ethanol, water, liquid soap, towels, scourer, drilling bits, soldering wire
Special notes	Some patients beds are electrical therefore an electrical safety test must be performed Its best to purchase the electrical and mechanical toolkit because it contains all the required tools Trainer should concentrate on patient beds, bedside lockers, trolleys, ward screens and examination coaches as medical furniture that can be handled at Level 1

Code	UE/BMT/M1.3
Module title	**M1.3: Repair Biomedical Equipment**
Related Qualification	Part of Uganda Vocational Qualification (Biomedical Technologist UVQ 1)
Qualification Level	1
Module purpose	At the end of this module, a trainee shall be able to repair Class I biomedical equipment
Learning-Working Assignments (LWAs)	**LWA 3/1: Repair Microscope** **LWA 3/2: Repair Stethoscope** **LWA 3/3: Repair Blood pressure machine** **LWA 3/4: Repair Pulse oximeter** **LWA 3/5: Repair Glucometer** **LWA 3/6: Repair Weighing scale** **LWA 3/7: Repair Roller mixer** **LWA 3/8: Repair Hospital medical furniture** **LWA 3/9: Perform occupational health, safety and environmental protection practices (OHSEPP)** ***Note:*** 1. *The learning exercises may be repeated till the Trainee acquires targeted competence;* 2. *The Trainer is advised to deliver relevant theoretical instruction with demonstrations as required to perform each learning working assignment.*
Related Practical Exercises (PEXs)	**LWA 3/1: Repair Microscope** PEX 1.1: Review equipment history PEX 1.2: Inspect equipment PEX 1.3: Identify faulty and worn out parts of equipment PEX 1.4: Replace lenses PEX 1.5: Replace bulb PEX 1.6: Replace eyepieces PEX 1.7: Replace mirrors PEX 1.8: Replace knobs PEX 1.9: Replace diaphragm PEX 1.10: Repair power supply board

	PEX 1.11: Lubricate equipment PEX 1.12: Perform electrical safety test PEX 1.13: Perform functional test PEX 1.14: Write job card
	LWA 3/2: Repair Stethoscope PEX 2.1: Review equipment history PEX 2.2: Inspect equipment PEX 2.3: Identify faulty equipment parts PEX 2.4: Replace tubing PEX 2.5: Replace diaphragm PEX 2.6: Replace ear pieces PEX 2.7: Perform functional test PEX 2.8: Write job card
	LWA 2/3: Repair Blood Pressure machine PEX 3.1: Review equipment history PEX 3.2: Inspect equipment PEX 3.3: Identify faulty and worn out parts of equipment PEX 3.4: Replace display, mercury column, gauge PEX 3.5: Replace tubing PEX 3.6: Replace valves PEX 3.7: Replace rubber bulb PEX 3.8: Replace cuff and zipper bag PEX 3.9: Replace motor PEX 3.10: Refill mercury PEX 3.11: Re-align springs PEX 3.12: Lubricate pointer PEX 3.13: Calibrate equipment PEX 3.14: Perform electrical safety test PEX 3.15: Perform functional test PEX 3.16: Write job card
	LWA 3/4: Repair Pulse oximeter PEX 4.1: Review equipment history PEX 4.2: Inspect equipment PEX 4.3: Identify faulty and worn out parts of equipment PEX 4.4: Replace pulse Oximeter probe PEX 4.5: Replace batteries PEX 4.6: Calibrate equipment

	PEX 4.7: Update equipment software PEX 4.8: Perform electrical safety test PEX 4.9: Perform functional test PEX 4.10: Write job card
	LWA 3/5: Repair Glucometer PEX 5.1: Review equipment history PEX 5.2: Inspect equipment PEX 5.3: Identify faulty and worn out parts of equipment PEX 5.4: Replace strip port PEX 5.5: Replace batteries PEX 5.6: Calibrate equipment PEX 5.7: Clean equipment PEX 5.8: Perform electrical safety test PEX 5.9: Perform functional test PEX 5.10: Write job card
	LWA 3/6: Repair Weighing scale PEX 6.1: Review equipment history PEX 6.2: Inspect equipment PEX 6.3: Identify faulty and worn out parts of equipment PEX 6.4: Replace faulty and worn out parts PEX 6.5: Re-align springs PEX 6.6: Lubricate pointer and turning knob PEX 6.7: Calibrate equipment PEX 6.8: Perform electrical safety test PEX 6.9: Perform functional test PEX 6.10: Write job card
	LWA 3/7: Repair Roller mixer PEX 7.1: Review equipment history PEX 7.2: Inspect equipment PEX 7.3: Identify faulty and worn out parts of equipment PEX 7.4: Replace rollers PEX 7.5: Repair motor PEX 7.6: Lubricate equipment PEX 7.7: Calibrate equipment PEX 7.8: Perform electrical safety test PEX 7.9: Perform functional test PEX 7.10: Write job card

	LWA 3/8: Repair Hospital medical furniture PEX 8.1: Review equipment history PEX 8.2: Inspect equipment PEX 8.3: Identify faulty and worn PEX 8.4: Replace castor wheels PEX 8.5: Repaint equipment PEX 8.6: Replace Macintosh PEX 8.7: Replace screens (ward screens) PEX 8.8: Refill hydraulic fluid (patient beds) PEX 8.9: Replace trolley trays PEX 8.10: Replace bedside locker compartments PEX 8.11: Lubricate moving parts PEX 8.12: Perform electrical safety test PEX 8.13: Perform functional test PEX 8.14: Write job card
	LWA 3/9: **Perform occupational health, safety and environmental protection practices (OHSEPP)** PEX 9.1: Clean workplace PEX 9.2: Wear protective gears PEX 9.3: Perform fire fighting PEX 9.4: Perform First aid PEX 9.5: Manage waste PEX 9.6: Maintain personal hygiene PEX 9.7: Sanitize tools and equipment PEX 9.9: Display safety signs materials
Occupational health and safety	Precautions, rules and regulations on occupational health, safety and environmental protection, included in the listed related knowledge should be observed and demonstrated during LWAs and PEXs.
Pre-requisite modules	None
Related knowledge/ theory	*For Occupational theory suggested for instruction/ demonstration, the Trainer is not limited to the outline below. In any case, related knowledge/ theory may be obtained from various recognized reference materials as appropriate:* • Basic anatomy

	• Electrical knowledge • Bioinstrumentation • Physics and mechanics • ICT • Engineering Mathematics • How to assemble different medical equipment • Working in a well-ventilated environment • Types of hazardous materials and how to use and store them • How to write a job card • How to conduct hands on user training • How to perform an electrical safety test and equipment functional test • How to review equipment history • How to write a detailed report about equipment repair • How to interpret troubleshooting manual • Principles of operation of different medical equipment • Tools and materials used in repair • Communication skills • Record keeping
Average duration of learning	*1200 hours (150 days) of nominal learning suggested to include:* • *50 days of occupational theory and* • *100 days of occupational practice*
Suggestions on organization of learning	The acquisition of competencies (skills, knowledge, attitudes) described in this module may take place at a training centre or its equivalent provided all equipment and materials required for training are in place.
Assessment	Assessment to be conducted according to established regulations by recognized assessment body using related Practical and Written Test Items from Item bank.
Minimum required tools/ equipment/ implements or equivalent	Microscope, infusion pump, blood pressure machine, pulse oximeter, roller mixer, water bath, glucometer, weighing scale, stethoscope, patient beds, trolleys, bedside lockers, examination coaches, ward screens, screw drivers, tester, multimeter, torques, wrench, hand drill, pair of pliers, wire cutters, wire strippers, allen keys, electrical safety tester,

	blower, brooms, squeezers, moppers, soldering gun, protective gears, fix and ring spanners, adjustable spanners, torch, magnifiers and flash lights, paint brushes
Minimum required materials and consumables or equivalent	Pens, pencils, notebook, Lubrication materials – WD 40, grease (hospital furniture), gauze, cotton, lens cleaner, 70% ethanol, water, liquid soap, towels, scourer, drilling bits, soldering wire, mercury, NIBP cuff, fuses, copper wires, batteries, reusable SPO_2sensors,glucometer strips, weights, sanitizer, insulating tape, sticky glue, grease, castors, paint, electronic components, electrical wires
Special notes	Some patients beds are electrical therefore an electrical safety test must be performed Its best to purchase the electrical and mechanical toolkit because it contains all the required tools Trainer should concentrate on patient beds, bedside lockers, trolleys, ward screens and examination coaches as medical furniture that can be handled at Level 1

Code	**UE/BMT/M1.4**
Module title	**M1.4: Perform Entrepreneurship skills**
Related Qualification	Part of Uganda Vocational Qualification (Biomedical Technologist UVQ 1)
Qualification Level	1
Module purpose	After completion of this module, the trainee shall be able to market biomedical products and services
Learning-Working Assignments (LWAs)	**LWA 4/1: Set up Biomedical Enterprise** **LWA 4/2: Market Biomedical products and services** **LWA 4/3: Keep records** **LWA 4/4: Perform occupational health, safety and environmental protection practices (OHSEPP)** ***Note:*** *1. The learning exercises may be repeated till the Trainee acquires targeted competence;* *2. The Trainer is advised to deliver relevant theoretical instruction with demonstrations as required to perform each learning working assignment.*
Related Practical Exercises (PEXs)	**LWA 4/1: Set up Biomedical Enterprise** PEX 1.1: Develop business plan PEX 1.2: Conduct feasibility study PEX 1.3: Prepare workplace PEX 1.4: Register enterprise PEX 1.5: Source for funds PEX 1.6: Procure tools, materials and equipment PEX 1.7: Recruit staff PEX 1.8: Assign roles PEX 1.9: Take inventory
	LWA 4/2: Market Biomedical products and services PEX 2.1: Perform market survey PEX 2.2: Advertise products and services PEX 2.3: Price products and services PEX 2.4: Sell products and services

	LWA 4/3: Keep records PEX 3.1: Keep financial records PEX 3.2: Keep human resource records PEX 3.3: Keep inventory records PEX 3.4: Keep performance records
	LWA 4/4:Perform occupational health, safety and environmental protection practices (OHSEPP) PEX 4.1: Clean workplace PEX 4.2: Wear protective gears PEX 4.3: Perform fire fighting PEX 4.4: Administer First aid PEX 4.5: Manage waste PEX 4.6: Maintain personal hygiene PEX 4.7: Sanitize tools and equipment PEX 4.8: Display safety signs PEX 4.9: Label materials and equipment
Occupational health and safety	Precautions, rules and regulations on occupational health, safety and environmental protection, included in the listed related knowledge should be observed and demonstrated during LWAs and PEXs.
Pre-requisite modules	None
Related knowledge/ theory	*For Occupational theory suggested for instruction/ demonstration, the Trainer is not limited to the outline below. In any case, related knowledge/ theory may be obtained from various recognized reference materials as appropriate:* • How to conduct hands on user training • Principles of operation of different medical equipment • Tools and materials used in r • Communication skills • Records management • Planning skills • ICT • Financial management skills • Resource mobilization • Human resource management • Marketing skills

	• How to write business plan • How to register a company or enterprise
Average duration of learning	*240 hours (30 days) of nominal learning suggested to include:* • *10 days of occupational theory and* • *20 days of occupational practice*
Suggestions on organization of learning	The acquisition of competencies (skills, knowledge, attitudes) described in this module may take place at a training centre or its equivalent provided all equipment and materials required for training are in place.
Assessment	Assessment to be conducted according to established regulations by recognized assessment body using related Practical and Written Test Items from Item Bank
Minimum required tools/ equipment/ implements or equivalent	Computer, printer/photocopier, projector, phones, collater
Minimum required materials and consumables or equivalent	Stationery, internet
Special notes	

3.0 ATP- PART III
Assessment Instruments for BIOMEDICALTECHNOLOGIST

3.1 Assessment of occupational competence is the procedure by which evidence is gathered and judged to decide if an individual (candidate) has met the stipulated assessment standards.

3.2 Assessment of occupational competence should comprise of both practical (Performance) testing and written (theory/knowledge) testing.

3.3 Based on the Occupational Profile and Training Modules, a combined panel of job practitioners and Instructors developed a substantial number of test items for assessing (practical) performance as well as items for assessing occupational knowledge (theory) all stored in an electronic Test Item Bank (TIB) at the Directorate of Industrial Training.

3.4 Performance (Practical)Test Items (PTI)are closely related to typical work situations in Ugandan business enterprises. They comprise of a test assignment for candidates and assessment criteria and/or scoring guides for assessors' use.

3.5 Written Test items (WTI) for written testing of occupational theory, (knowledge) are presented in different forms which include:

- Short answer test items.
- Multiple choice test items,
- Matching test items.

These WTIs herein focus on functional understanding as well as trouble-shooting typically synonymous with the world of work.

3.6 Composition of assessment/test papers will always require good choices of different types of WTI in order to ensure the assessment of relevant occupational knowledge required of candidates to exhibit competence.

3.7 The test items contained in the Test Item Bank may be used for continuous/formative assessment during the process of training as well as for summative assessment of candidates who have acquired their competences non-formally or informally.

3.8 In this document, only sample test items for assessing (practical) performance and occupational knowledge (theory) of a Biomedical Technologist are included. A larger selection of test items can be obtained from an electronic Test Item Bank at Directorate of Industrial Training.

3.1 Overview of Test Item Samples Included

No	Type of test Items	Numbers included
1.	Written (Theory)- Short Answer	2
2.	Written (Theory)- Multiple Choice	2
3.	Written (Theory)- Matching with generic	1
4.	Written (Theory)- Matching cause and effect	1
5.	Written (Theory)- Matching Work sequence	1
6.	Performance (Practical)Test Items	2
Total		9

WRITTEN TEST ITEMS (SAMPLES)

<table>
<tr><td>DIT/ QS</td><td colspan="4">Test Item Database
Written (Theory) Test Item no. 1</td></tr>
<tr><td>Occupational Title:</td><td colspan="4">Biomedical Technologist</td></tr>
<tr><td>Competence level:</td><td colspan="4">Level 1</td></tr>
<tr><td>Code no.</td><td colspan="4"></td></tr>
<tr><td>Test Item type:</td><td colspan="4"><table>
<tr><td>Short answer</td><td colspan="3">✓</td></tr>
<tr><td>Multiple choice</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Matching item</td><td>Generic</td><td>Cause-Effect</td><td>Work-sequence</td></tr>
<tr><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Complexity level:</td><td colspan="4">C1</td></tr>
<tr><td>Date of OP:</td><td colspan="4">January, 2022</td></tr>
<tr><td>Related modules:</td><td colspan="4">M1.1, M1.2</td></tr>
<tr><td>Time allocation:</td><td colspan="4">2 minutes</td></tr>
</table>

Test Item	Define equipment inventory
Answer space	i ……..
Expected Key (answers)	i Is a list of all equipment types ii Is a tool for developing an efficient and effective biomedical maintenance management function

DIT/ QS	Test Item Database Written (Theory) Test Item no. 2
Occupational Title:	Biomedical Technologist
Competence level:	Level 1
Code no.	
Test Item type:	Short answer ✓ Multiple choice Matching item: Generic / Cause-Effect / Work-sequence
Complexity level:	C1
Date of OP:	January, 2022
Related modules:	M1.
Time allocation:	2 minutes

Test Item	List four parts of a microscope
Answer space	i ..... ii ..... iii ..... iv .....
Expected Key (answers)	i Eye piece lens ii Objective lens iii Stage iv Clips v Condenser lens vi Diaphragm vii Handle viii Base ix Revolving nose piece x Mirror xi Bulb xii Micrometer screw/ fine adjustment knob xiii Macrometer screw/ coarse adjustment knob

DIT/ QS	Test Item Database Written (Theory) Test Item no.3			
Occupational Title:	Biomedical Technologist			
Competence level:	Level 1			
Code no.				
Test Item type:	Short answer			
	Multiple choice	✓		
	Matching item	Generic	Cause-Effect	Work-sequence
Complexity level:	C2			
Date of OP:	January, 2022			
Related modules:	M1.2			
Time allocation:	2 minute			

Test Item	The following is used as lubricant during maintenance of weighing scale

Distractors and correct answers	A. Oil B. Grease C. Ethanol D. WD- 40

Key (answer)	D

<table>
<tr><th>DIT/ QS</th><th colspan="4">Test Item Database
Written (Theory) Test Item no.4</th></tr>
<tr><td>Occupational Title:</td><td colspan="4">Biomedical Technologist</td></tr>
<tr><td>Competence level:</td><td colspan="4">Level 1</td></tr>
<tr><td>Code no.</td><td colspan="4"></td></tr>
<tr><td rowspan="4">Test Item type:</td><td>Short answer</td><td colspan="3"></td></tr>
<tr><td>Multiple choice</td><td colspan="3">✓</td></tr>
<tr><td rowspan="2">Matching item</td><td>Generic</td><td>Cause-Effect</td><td>Work-sequence</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Complexity level:</td><td colspan="4">C2</td></tr>
<tr><td>Date of OP:</td><td colspan="4">January, 2022</td></tr>
<tr><td>Related modules:</td><td colspan="4">M1.1, M1.2, M1.3</td></tr>
<tr><td>Time allocation:</td><td colspan="4">2 minute</td></tr>
</table>

Test Item	What does a pulse oximeter reading mean?

Distractors and correct answers	A. Heart rate B. Blood pressure C. Glucose levels D. Oxygen saturation

Key (answer)	D

DIT/ QS	Test Item Database Written (Theory) Test Item no. 5
Occupational Title:	Biomedical Technologist
Competence level:	Level 1
Code no.	
Test Item type:	Short answer:
	Multiple choice:
	Matching item: Generic √ / Cause-Effect / Work-sequence
Complexity level:	C2
Date of OP:	January, 2022
Related module:	M1.1, M1.2, M1.3
Time allocation:	5Minutes

Test Item	Match the following blood pressure machine parts to their functions

	Column A (Parts)
A	Bulb
B	Pressure relief valve
C	Tubing
D	Inflatable cuff
E	Gauge
F	Zipper bag

	Column B (Functions)
1	Display blood pressure reading
2	Exert pressure on arteries
3	Enclose cuff
4	Powering machine
5	Measuring pressure saturation
6	Inflates cuff
7	Control deflation of cuff
8	Transfer of pressure from bulb

Key (answer)	A-6, B-7, C-8, D-2, E-1, F-3

DIT/ QS	Test Item Database Written (Theory) Test Item no. 6
Occupational Title:	Biomedical Technologist
Competence level:	Level 1
Code no.	
Test Item type:	Short answer Multiple choice Matching item (Generic: ; Cause-Effect: √ ; Work-sequence:)
Complexity level:	C3
Date of OP:	January, 2022
Related module:	M1.2, M1.3
Time allocation:	5 Minutes

Test Item	Match the following defects on an infusion pump with their causes

Column A (Defects)	
1	Occlusion
2	Air bubble
3	Battery failure
4	Electric sparks
5	Motor failure
6	Intravenous medication error

Column B (Causes)	
A	Depreciated batteries
B	Machine not plugged in power
C	Closed or twisted giving set
D	Low flow of drug in the bag
E	Loose connections
F	Wrong parameter settings
G	Mis-alignment of giving set
H	Faulty fuse

Key (answer)	1-C; 2-D; 3-A; 4-E, 5-G, 6-F

DIT/ QS	Test Item Database Written (Theory) Test Item no.7
Occupational Title:	Biomedical Technologist
Competence level:	Level 1
Code no.	
Test Item type:	Short answer:
	Multiple choice:
	Matching item: Generic: ; Cause-Effect: ; Work-sequence: √
Complexity level:	C2
Date of OP:	January, 2022
Related module:	M1.2
Time allocation:	3 Minutes

Test Item	Arrange the following steps in order of taking blood pressure measurements

Column A (chronology	**Column B (work steps) in wrong chronology order**	
1st	A	Close pressure relief valve on the bulb
2nd	B	Locate pulse
3rd	C	Inflate cuff
4th	D	Roll up sleeves
5th	E	Sit patient comfortably
6th	F	Fit cuff around patients upper arm
7th	G	Check cuff size
8th	H	Detach cuff from patient arm
9th	I	Open pressure relief valve completely
10th	J	Take readings

Key (answer)	1-E, 2-D, 3-G, 4-B, 5-F, 6-A, 7-C,8-J, 9-I, 10-H

PERFORMANCE TEST ITEMS (SAMPLES)

DIT/ QS	Test Item Database Performance Test Item No.8
Occupational Title:	Biomedical Technologist
Competence level:	Level 1
Code no.	
Test Item:	Service mechanical adult weighing scale
Complexity level:	P2
Date of OP:	January, 2022
Related modules:	M1.2
Related skills and knowledge:	• How to write equipment inventory • Occupational health and safety • Selecting tools and materials • Principles of operation of weighing scale • Record keeping skills • Communication skills
Required tools, Materials and Equipment:	Mechanical adult weighing scale, WD-40, screw drivers, nozzle, pair of pliers, adjustable spanner, gauze, first aid kit, allen keys, blower
Time allocation:	2 Hours
Preferred venue:	Biomedical Workshop
Remarks for candidates	• Should be dressed in full personal protective gears • Cleaning of working place should be continuous
Remarks for assessors	• Avail the candidates with all the required materials, tools and equipment.

#	Assessment criteria	Scoring guide	Max. Score	
			Process	Result
1	Preparation for task	**Wore personal protective gears** Mask Safety gloves Safety boots Overall		 1 1 1 1
		Clean safety gear worn		2
		Assembled tools, equipment and materials		2
2	Inspect equipment	Checked for physical damages	3	
		Checked for zero reading error	2	
		Opened weighing scale	3	
		No damages, scratches or cracks observed (screws and external surface off equipment)		1
		Checked physical state of pointer	1	
		Checked physical state of springs	2	
		Checked gears	2	
3	Clean equipment	Cleaned external surface of equipment	2	
		Dirt free surface observed		1
		Blow dust from machine	2	
		Dust free machine observed		1
		Cleaned gears	3	
		Dirt free gears observed		3
4	Lubricate equipment	Lubricated gears		3
		Lubricated joints		3
		Lubricated pointer		2

#	Assessment criteria	Scoring guide	Max. Score	
			Process	Result
5	Perform functional test	Calibrated scale	4	
		Re-aligned or replaced springs		3
		Checked movement of pointer	2	
		Scale at zero mark observed		2
		Placed known weight on the equipment	3	
		Adjusted reading of known weight	3	
		Correct reading of known weight observed		2
6	Completion of task	Prepared/ wrote job card		3
		Attached service sticker on the equipment		2
		Cleaned equipment		2
		Cleaned workplace		2
		Stored tools and materials		2
TOTAL			32	40
Maximum Score (Y)		**(X/Y)*100**	**X/72)*100**	

DIT/ QS	Test Item Database Performance Test Item No.9
Occupational Title:	Biomedical Technologist
Competence level:	Level 1
Code no.	
Test Item:	Install light microscope
Complexity level:	P3
Date of OP:	January, 2022
Related modules:	M1.1
Related skills and knowledge:	• How to write equipment inventory • Occupational health and safety • Selecting tools and materials • Principles of installation and operation of microscope • Training user after installation • Calibration skills • Record keeping skills • Communication skills • Interpreting installation manual
Required tools, Materials and Equipment:	Screw drivers, nozzle, pair of pliers, adjustable spanner, gauze, first aid kit, allen keys, slides, multimeter, lens tissue
Time allocation:	2 1/2 Hours
Preferred venue:	Biomedical Workshop
Remarks for candidates	• Should be dressed in full personal protective gears • Cleaning of working place should be continuous
Remarks for assessors	• Avail the candidates with all the required materials, tools and equipment.

#	Assessment criteria	Scoring guide	Max. Score	
			Process	Result
1	Preparation for task	**Wore personal protective gears** Mask Gloves Safety boots Overall		 1 1 1 1
		Clean safety gear worn		2
		Mobilized tools, equipment and materials		2
		Prepared work station		2
2	Assemble equipment	Verified availability of all equipment parts	2	
		Inspected different parts of microscope	3	
		Stationed base of microscope	2	
		Connected objective lenses and eye piece to main unit	3	
		Correct thread alignment of objective lens observed		2
		Assembled stage and clip	3	
		Attached adjusting knobs	3	
		Installed bulb or mirror	2	
		Installed condenser lens	2	
		Installed diaphragm	2	
3	Perform electrical safety test	Checked power supply (socket)	2	
		Leakage voltage $\pm$ 5V		2
		Voltage range between 220-240V		2
		Checked continuity of power cable	2	
		Checked continuity of fuse	2	
		Connected equipment to power source	1	

#	Assessment criteria	Scoring guide	Max. Score	
			Process	Result
4	Perform functional test	Powered equipment	1	
		Functional lighting system observed		2
		Checked for damages and dirt on lenses	3	
		Aligned lenses	4	
		Checked for movement of stage	2	
		Movement of stage observed		2
		Checked for movement of adjustment knobs	2	
		Movement of adjustment knobs observed		2
		Checked movement of revolving nosepiece	2	
		Movement of revolving nosepiece		1
		Checked opening and closing of diaphragm	2	
		Opening and closing of diaphragm observed		1
		Checked clip	1	
		Clip holding the slides firmly in place		1
		Clear image observed through the lenses		3
5	Completion of task	Prepared/ wrote job card		3
		Cleaned equipment		2
		Cleaned workplace		2
		Stored tools and materials		2
		Conducted hands on end user training	3	
TOTAL			49	37
Maximum Score (Y)		**(X/Y)*100**	**X/80)*100**	

4.0 ATP- PART IV

INFORMATION ON DEVELOPMENT PROCESS

4.1 Occupational Profile Development (January 2022)

The Occupational Profile was exclusively developed by job practitioners who were working in the Biomedical Technologists occupation. The job expert panel, guided by UVQF Facilitators defined duties and tasks performed and provided additional generic information regarding the occupation.

4.2 Training Module Development (January 2022)

Based on the Occupational Profile for Biomedical Technologists of January 2022Training Modules were developed by job practitioners, guided by UVQF Facilitators.

4.3 Test Item Development (January 2022)

Based on the Occupational Profile for Biomedical Technologists of January 2022, and Training Modules, Test Items were developed by combined panels of instructors and job practitioners, guided by UVQF Facilitators.

4.4 Methodology

The rationale for the Assessment and Training Package development was to link Vocational Education and Training to the real world of work by bridging Occupational Standards to Training Standards through industry-led Standards-Based Assessment.

Active participation of both instructors and job practitioners' panels consolidated the development philosophy.

The panelists worked as teams in workshop settings complemented by off-workshop field research and literature review activities including international benchmarking.

4.5 Development Panels

The participating panels of Job Practitioners required at different stages were constituted by members from the following organizations:

ATP DEVELOPMENT Stage		
No.	**Name**	**Institution/ Organization**
1.	Kibedi Dorothy	Ministry of Education and Sports
2.	Janja Bernard	National Curriculum Development Centre
3.	Tiragana George	Ntare School
4.	Opira Benson	Sacred Heart SS Girls School- Gulu
5.	Mutiibwa Francis Emmanuel	St Mary's College Namagunga
6.	Butono Paul	Busoga College Mwiri
7.	Lukung Amiri	Greenhill Academy – Kibuli Campus
8.	Kemigisha Priscilla	Ernest Cook Ultrasound Research and Education Institute
9.	Muhumuza Ivan	Mbarara University of Science and Technology
10.	Luswata Moses	Medequip (U) LTD
11.	Lubadde Jessy	St Francis Hospital Nsambya

4.6. Facilitator team

This Assessment and Training Package was developed by a Facilitator team listed below:

1. **Team Leader -** Ms. Mukyala Ruth, Ag Deputy Director, DIT;
2. **Facilitators –** Ms Baliraba Elizabeth A&C and Nabirye Asha QS
3. **Data Entrants –** Ms Nahwera Agnes QS, Ms Tibesigwa Racheal QS
4. **Compiled by** Baliraba Elizabeth A&C; and edited by Ms. Mukyala Ruth, Ag DD, DIT,
5. **Coordinated by –** Mr. Byakatonda Patrick, Director, DIT;Ms. Mukyala Ruth, Ag DD, DIT

4.7 Reference time:

The Assessment and Training Package was compiled in December 2020 and may be periodically revised to match the dynamic trends in the occupation and hence issued in different versions.

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