SECTION A:	***QUALIFICATION DETAILS***																	
QUALIFICATION DEVELOPER (S)	Kitso International College																	
TITLE	Diploma in Automotive Mechanical Technology (AMT)														***NCQF LEVEL***		*6*	
FIELD	Manufacturing, Engineering and Technology			***SUB-FIELD***		Automotive Mechanical									***CREDIT VALUE***		*390*	
New Qualification			√											*Review of Existing Qualification*				
SUB-FRAMEWORK	*General Education*					*TVET*						√	*Higher Education*					
QUALIFICATION TYPE	*Certificate*	*I*		*II*		*III*		*IV*		*V*			*Diploma*	√	*Bachelor*			
	Bachelor Honours					*Post Graduate Certificate*							*Post Graduate Diploma*					
	Masters							*Doctorate/ PhD*										

RATIONALE AND PURPOSE OF THE QUALIFICATION

RATIONALE:

The rationale of the **Diploma in Automotive Mechanical Technology (AMT)** is premised on the following national strategic planning documents and annual reporting documents from Botswana's key governance institutions; Botswana National Development Plan 10 and 11 advocated for the development of skills aligned to the country's labour market based on the Human Resource Development Strategy survey administered by the Human Resources Development Council (HRDC). Automotive Engineering was identified as a key area for skills development. The following skills in the Automotive Engineering area are illustrated as in the document found on the link below from the HRDC 2016 report Top 20 Occupations[1]. The skills required are Heavy Plant Mechanic, Hydraulics Mechanic, Diesel Mechanic, and Auto Electricians. These skills were identified as top priority skills areas for human capital development. HRDC Report (2016).

According to the Central Statistical Office (CSO) of Botswana Report on Transport & Infrastructure Statistics Report (2017, pg11), the national vehicle stock increased from 256,498 vehicles to 527,901 by 2017. The growth was largely attributed to privately owned vehicles which constitute 97.6% of the total vehicle population which occurred at an average growth of 18243 vehicles per year from 2008 to 2017. The CSO further reported that vehicle accidents that occur constituted vehicle rollover", "side vehicle" collisions accidents, "rear end" and "head on" collusions. An accident-damaged vehicle entails repairing structural and non-structural damages. The skills in Automotive Mechanical or Electrical Technology henceforth form an essential set of skills needed for repairing accident-damaged cars. Skills in Automotive Mechanic or Mechanical Technology are the skills needed to repair and install any mechanical systems, subsystems, and components. This sentiment is also expressed by the Bank of Botswana Annual report (2015, p92) which mentions that "as a landlocked country, Botswana is heavily dependent on efficient transport and communications and where utility provision is relatively expensive and erratic, business face productivity and competitiveness challenges.

Efficient Transport implies the maintenance and installation of functional mechanical systems by Automotive Mechanical technicians. Therefore, the development of human capital that has critical automotive mechanical technology skills for the automotive engineering industry is not an option but a must as it is contributory to the economy's vibrancy. To viewpoints shared by the Ministry of Trade and Industry as expressed in their Economic Diversification Drive: Medium to Long-term Strategy Plan (2011-2016). Transport plays a critical role in the prioritized economy drive sectors such as Agro-processing, Leather and ternary, renewable energy, primary production, construction, building, and mining.

Automotive Engineering skills are also playing a very critical role in the country's formal and informal sectors of Botswana's economy. Therefore, training people in Automotive Engineering skills is not only rendering services to the labour market but is also playing a critical role in SME formation and hence employment creation, poverty reduction and economic diversification.

PURPOSE:

The purpose of the diploma in Automotive Mechanical Technology qualification is to provide auto mechanics with knowledge, skills, and competence to;

- Assemble, fit, and repair automobile auxiliary harnesses.
- Perform basic welding/joining of metals.

- Remove and fit automobile components.
- Select and use vehicle lifting equipment.
- Select, use, and care for engineering hand and power tools.
- Comply with safety, health, and environmental requirements in the workplace.
- Understand and apply fundamentals of engine mechanical technology.
- Apply engine internal combustion maintenance and service.
- Repair and maintain the mechanical systems and components of cars, motorcycles, and heavy vehicles.
- Diagnose, repair, and service cars, light trucks, SUVs, and school buses.

ENTRY REQUIREMENTS (including access and inclusion)

Minimum entry requirement for this qualification is a:

Certificate IV, NCQF Level 4, or equivalent, best 6 subjects with a C or better in English, Mathematics, Physics and Chemistry.

Recognition of Prior Learning (RPL):

There shall be provision for entry through Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT) in line with institutional and national policies.

SECTION B	***QUALIFICATION SPECIFICATION***
GRADUATE PROFILE (LEARNING OUTCOMES)	***ASSESSMENT CRITERIA***
LO1: Apply knowledge and understanding of Safety, Health, and Environmental Risk (SHER).	1.1 Observe personal safety for all stakeholders and ensure the applications of the legislative regulatory requirements. 1.2 Identify hazards in the workplace that pose danger to personal health and provide solutions to them in accordance with regulated safety standards per the industry. 1.3 Maintain a register of the occurrence of incidents of accidents in line with organizational requirements. 1.4 Apply appropriate action to control unsafe or unhealthy hazards and propose methods of eliminating them.
LO2: Demonstrate knowledge and skill of engine internal combustion maintenance and service.	2.1 Explain and demonstrate the steps required to change engine oil and filter. 2.2 Identify and correct vehicle leaks in fuel, lubrication and cooling systems, and other vehicle liquids. 2.3 Diagnose engine noises and vibrations. 2.4 Diagnose fuel, lubrication and cooling systems and repair as necessary.
LO3: Apply knowledge and skill of engine reconditioning processes.	3.1 Demonstrate disassembling of the automotive engine in preparation for reconditioning. 3.2 Demonstrate the recommended procedures for engine cylinder block reconditioning. 3.3 Demonstrate the recommended procedures for crankshaft reconditioning. 3.4 Demonstrate engine reassembly. 3.5 Demonstrate the procedure for valve reconditioning.

	3.6 Demonstrate the sequence of steps in cylinder head reconditioning. 3.7 Perform cylinder head tests and analyze results.
LO4: Diagnose and repair vehicle ignition and fuel systems	4.1 Test vehicle fuel pumps and pump control systems for pressure, regulation, and volume. 4.2 Test and service vehicle fuel injectors. 4.3 Diagnose and repair vehicle ignition and fuel system problems. 4.4 Test and diagnose vehicle ignition control module, power train/engine control module.
LO5: Apply knowledge and skill of automotive electrical and electronic components.	5.1 Interpret wiring diagrams during diagnosis of electrical and electronic circuit problems. 5.2 Inspect and test sensors, connectors, and wires of electronic (digital) instrument circuits. 5.3 Diagnose body electronic circuits using a scan tool. 5.4 Apply software transfers, and software updates of flush reprogramming on electronic modules. 5.5 Analyze complex vehicle circuits and diagrams. 5.6 Test vehicle electrical and electronic circuits according to manufacturer's specifications.
LO6: Perform engine management tests and diagnosis on petrol and diesel engines.	6.1 Demonstrate cylinder power balance test. 6.2 Demonstrate procedures to use gas analyzers, and extract and interpret their readings. 6.3 Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data. 6.4 Demonstrate live/series data and active tests of actuators and sensors using digital scan tools.
LO7: Diagnose and analyze vehicle braking system problems.	7.1 Observe safe practices and procedures when working on vehicle brake systems.

	7.2 Demonstrate knowledge and skill in dismantling and re-assembling brake components. 7.3 Diagnose manual braking systems. 7.4 Diagnose electronic brake control systems using digital scan tools.
LO8: Demonstrate knowledge and skill to attend to Manual and Automatic Transmission problems.	8.1 Identify and differentiate transmission systems. 8.2 Demonstrate the process of manual clutch replacement. 8.3 Perform the disassembly and re-assembly of a manual transmission system. 8.4 Demonstrate the maintenance and service of automatic transmission system components. 8.5 Diagnose electronically operated transmissions and their control systems using a digital scan tool.
LO9: Demonstrate knowledge and skill on wheels, suspension and steering systems.	9.1 Perform wheel and tyre diagnosis and repair. 9.2 Demonstrate the pre-alignment inspection of suspension and steering components. 9.3 Diagnose and repair suspension and steering systems. 9.4 Perform wheel balancing and alignment on digital machines.
L10: Apply scientific and mathematical techniques to solving problems in trade-related challenges.	10.1 Use graphs, tables, and charts to present work-related results. 10.2 Demonstrate skill in the application of scientific laws and principles in trade-related problem-solving. 10.3 Interpret vehicle parameters and data using calculus and differentiation concepts.
LO11: Ability to read, interpret and construct engineering drawings and circuits.	11.1 Select the appropriate drawing equipment to be used.

	11.2 Produce drawings according to the task specifications whilst observing strict adherence to safety, health, and quality standards. 11.3 Analyze drawings to determine appropriate technical decision-making and equipment use.
LO12: Utilize CAD/CAM software to prepare technical graphics appropriate to the automotive engineering industry.	12.1 Construct block diagrams of engineering components/circuits used in day-to-day life. 12.2 Generate solid models and 2-D drawings of products adhering to standards. 12.3 Generate part model assembly of various machine components and systems using modellingngpackages. 12.4 Generate solid models and 3-D drawing for simple components. 12.5 Demonstrate knowledge of various codes and specifications of International Standards (ISO) concerned with engineering drawings. 12.6 Perform computer aided production planning, numerical control and Computer Numerical Control (CNC) programming. 12.7 Apply the principle of automation, the drafting and geometric modeling of database structure for graphics modeling.
LO13: Demonstrate knowledge and skill of different configurations of electric and hybrid vehicles.	13.1 Demonstrate the operational basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals. 13.2 Apply manufacturer's procedures on the maintenance and repair of plug–in hybrid electric vehicles and their power electronics devices. 13.3 Demonstrate knowledge of different energy storage technologies used for electric and hybrid vehicles and their control.

	13.4 Analyze various electric drives suitable for electric, hybrid vehicles and fuel cells.
LO14: Demonstrate knowledge, skill and overall understanding of office productivity tools.	14.1 Demonstrate proficiency in the use of spreadsheets, word processors, database management systems and presentation software. 14.2 Demonstrate proficiency in the use of Information Communication Technology (ICT) for effective business communication.
LO15: Demonstrate Entrepreneurial and Innovation skills.	15.1 Demonstrate knowledge and understanding on creating a business plan. 15.2 Demonstrate the ability to market one's services and ideas. 15.3 Demonstrate the ability to mobilize people and resources. 15.4 Demonstrate the ability to create value in service provision.
LO16: Ability to interpret basic laws, principles and phenomena in fluid mechanics.	16.1 Calculate operational parameters of hydraulic problems, systems and machines. 16.2 Apply tables and diagrams, and equations that define the associated laws. 16.3 Perform calculations involving energy exchange process in fluid machines. 16.4 Service and maintain performance of various pumps and turbines on vehicles. 16.5 Select practical engineering approaches to problem solving based on the acquired physics and mathematical knowledge in fluid mechanics.
LO17: Knowledge and skill in the service and maintenance of vehicle pneumatic systems and components.	17.1 Test and diagnose vehicle pneumatic systems and components. 17.2 Service and repair vehicle pneumatic systems and components. 17.3 Design practical vehicle pneumatic circuits targeted at problem solving.
LO18: Apply knowledge and skill of machine shop practices to include, human and equipment safety and operation, as it relates to an engineering environment.	18.1 Demonstrate knowledge of metallurgy and properties of other engineering materials. 18.2 Apply hand tools to perform machine shop bench operations. 18.3 Select and use temporary and permanent methods of joining metals and other engineering materials.

	18.4 Demonstrate application of machine tools to solve engineering tasks. 18.5 Perform different welding processes and explain their application on engineering materials and components.
19. Design and produce a model/artefact/service that is functional, affordable, enduring and economically beneficial	19.1 Research on potential and opportunity in the production of a model/artefact/service to solve an engineering problem. 19.2 Provide a detailed plan of action in the production of a model/artefact/service. 19.3 Organize an operational model in the production of a model/artefact/service by prioritizing time management, resource utilization and implementation. 19.4 Manage and monitor the task by comparing performance against set and approved standards and providing a remedial action plan. 19.5 Apply flexible knowledge and skill to produce the relevant model/artefact/service

SECTION C	***QUALIFICATION STRUCTURE***				
COMPONENT	***TITLE***	***Credits Per Relevant NCQF Level***			***Total Credits***
		Level [5]	***Level [6]***	***Level [ ]***	
FUNDAMENTAL COMPONENT *Subjects/ Courses/ Modules/Units*	Engineering Mathematics 1	15			15
	Engineering Mathematics 2		15		15
	Engineering Science	15			15
	Engineering Drawing	10			10
	Computer Fundamentals	10			10
	Technical Communication	10			10
	Machine Shop Practice	10			10
	Entrepreneurship		10		***10***
CORE COMPONENT *Subjects/Courses/ Modules/Units*	Engines Technology		10		10
	Automotive Transmission Systems		15		15
	Automotive Body Systems		10		10
	Automotive Chassis Systems		10		10
	Engine Electronic Control Systems		10		10
	Vehicle Electrics & Electronics Technology		15		15

	Hybrid and Electric Vehicles Technology		10		10
	On-Board Diagnostics		10		10
	Strength of Materials		10		10
	Mechanics of Machines		10		10
	Engineering Design and Synthesis		10		10
	Computer-Aided Design		15		15
	Workshop Organization & Safety Management	10			10
	Industrial Placement		50		50
	Workshop Practice		60		60
	Final Year Project		15		15
ELECTIVE/ OPTIONAL COMPONENT *Subjects/Courses/ Modules/Units* **Choose any TWO**	Wiring, Lighting and Accessories		10		***20***
	Vehicle Design		10		
	Customer Care & Industrial Rapport		10		
	Total				***390***

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	***Credit Value***
5	***85***
6	***305***
TOTAL CREDITS	***390***

Rules of Combination:

(Please Indicate combinations for the different constituent components of the qualification)

Rules of Combination

Compulsory Components Credits

- Core Modules 270 Credits
- Fundamental Modules 100 Credits

Elective Credits

- 2 Elective Modules 20 Credits

Distribution Rules:

- Level 5 with a maximum of 85 Credits
- Level 6 with a maximum of 305 Credits

ASSESSMENT ARRANGEMENTS

Assessment Weightings:

Formative Assessments shall constitute 50% Weighting on the Final Assessment, whilst Summative Assessments shall constitute 50%.

MODERATION ARRANGEMENTS

There shall be internal and external moderation arrangements done by BQA registered and accredited Moderators.

RECOGNITION OF PRIOR LEARNING

There will be a provision for awarding of the qualification through RPL mode which will be in line with the national RPL Policy.

CREDIT ACCUMULATION AND TRANSFER

There will be a provision for awarding of the qualification through CAT mode which will be in line with the national RPL and CAT Policy.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Horizontal articulation of Diploma in Automotive Mechanical Technology

1. Diploma in Automotive Collusion Estimation
2. Diploma in Automotive Repair and Finishing Technology
3. Diploma in Automotive Electrical Technology
4. Diploma in Automotive Diesel Technology

Vertical articulation for Diploma Automotive Mechanical Technology

1. Bachelor's in technology (B. Tech.) in Automotive Mechanical Technology
2. Bachelor's in technology (B. Tech.) in Automotive Collision Estimation

3. Bachelor's in technology (B. Tech.) in Automotive Repair and Refinishing Technology
4. Bachelor's in technology (B. Tech.) in Automotive Electrical Technology
5. Bachelor's in technology (B. Tech.) in Automotive Diesel Technology
6. Bachelor's in technology (B. Tech.) in Automotive Control Systems
7. Bachelor's in technology (B. Tech.) in Automotive Mechatronics

Career Path in Automotive Electrics

1. Automotive Technician
2. Mechanical Technician
3. Motor Vehicle Mechanical Repair Technician
4. Auto Service Advisor
5. Auto Shop Owner
6. Parts Professional

QUALIFICATION AWARD AND CERTIFICATION

Minimum Standards of Achievement for the Award of the qualification

A candidate is required to achieve the stipulated **390** total credits inclusive of the fundamental, core and elective components, to be awarded the **Diploma in Automotive Mechanical Technology (AMT)**.

Certification

Candidates meeting prescribed requirements will be awarded the **Diploma in Automotive Mechanical Technology (AMT)** in accordance with the standards prescribed for the award and applicable policies.

REGIONAL AND INTERNATIONAL COMPARABILITY

The **Diploma in Automotive Mechanical Technology (AMT)** offers design and synthesis, entrepreneurship and IT skills, as mandatory components of the curriculum. The qualification is outcome-based learning; therefore, emphasis is on hands-on skills and competency development. The qualification has also included industrial attached to further support the outcome-based approach. The qualification is, therefore, compatible and compliant with other qualifications sampled in the regional arena.

All the institutes ran the qualification on a two/three-year duration. All the qualifications have assessment strategies which include key strategies like projects, internships, workshop practice, theoretical evaluations, and work-based assessments. Conceptually, the learning outcomes tend to cover key domain areas like communication skills, teamwork skills, computer literacy skills and technical skills in vehicle maintenance and repair. Over 90% of the qualifications do internship and projects. They do have different names, but the content is averagely 80% to 90% similar. All qualifications offer internship or industrial attachment or work-based learning.

Though titles of the qualifications vary they deliver almost the same content. The qualification offers entrepreneurship, as a mandatory module, which is critical in the Botswana curriculum. All qualifications do not offer electives and entrepreneurship modules whereas this qualification goes with electives which allow for further specialisation, and also allows the graduates to have an option to become an industrialist with complementary modules

The qualification is outcome-based learning therefore and therefore is a huge emphasis on hands-on, development of skills and competencies. Two important modules, heavy plant on-board diagnostics and heavy plant pneumatics and hydraulics, ensures continuous practice of acquired knowledge and converted to skills and competencies. The qualification has also included industrial attachment to further support the outcome-based approach. The qualification is compatible and complaint to other qualifications sampled in the international arena.

REVIEW PERIOD

This qualification will be reviewed after a period of 5 Years