



WOLMER'S BOYS' SCHOOL

Department of: INDUSTRIAL AND VISUAL ARTS

Form: 4th

Subject: Mechanical Technology

Course Outline, September - June 2023/24

RATIONALE: This document seeks to inform fourth form students of the expectation of the subject area Mechanical Technology. The primary focus at this point is to introduce the CXC curriculum of Mechanical Technology to students. Students will complete theoretical modules as well as practical exercises.

GOALS:

At the end of the program students will

1. understand principles of Mechanical Engineering;
2. develop mechanical engineering skills;
3. develop cohesiveness.

CHRISTMAS TERM: September – December

<i>Week</i>	<i>Module/Unit</i>	<i>Topics</i>	<i>Lesson/Method of Delivery</i>	<i>Use of ICT</i>	<i>Student Assessment</i>
1	B11	FUNDAMENTALS OF INDUSTRY	<u>DISCUSSION</u> □ Definitions of: (i) an industry: - a construction; - a manufacturing; and, - an electrical and electronic □ The construction sectors: (i) residential; (ii) industrial; (iii) commercial; and, (v) civic. □ The roles of the following in the manufacturing sectors: (i) engineering design; (ii) industrial production; and, (iii) industrial maintenance.	Based on research state the fundamentals of industry.	Students will be evaluated based on a presentation. This presentation will state the fundamentals of industry.
2	B11	FUNDAMENTALS OF INDUSTRY	<u>DISCUSSION</u> □ Organisational structure (a) Organisational chart of	Based on research state the fundamentals of industry.	Students will be evaluated based on a presentation. This presentation will state

			personnel (managers, workers, tasks and relationships): (i) top-down structure; (ii) flat structure; and, (iii) matrix. <u>□</u> Occupational levels and their functions (a) Semi-skilled. (b) Skilled. (c) Technician supervisory. (d) Technologist/Master Craftsman. (e) Professional. <u>□</u> Construction industries: (i) craftsmen /tradesmen - carpenters, electricians, electronics technicians, masons, plumbers, furniture makers, woodcrafters, upholsterers, painters; welders, machine operators and fitters; (i) technical workers - technicians, technologists, finishing technicians; drafting and design technicians; and, (ii)		the fundamentals of industry.
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			professional workers - electrical, mechanical, construction structural, civil and building service engineers, architects, quantity surveyors, construction project managers, planners.		
3	B11	PREVENTATIVE MAINTENANCE	<u>THE REASON FOR PREVENTATIVE MAINTENANCE</u> ☐ List the six functions of a typical PM program. ☐ List the benefits of a PM program. ☐ Describe the steps involved in a P.M program.	Take pictures of preventative maintenance schedules within the workshop additionally, browse the internet for PM schedules.	Students will be required to create a P.M schedule of a workshop which will be scenario based.

			<u>SETTING UP A PM PROGRAM</u> ☐ Describe the elements needed to establish a PM Program. ☐ Distinguish between a preventative and predictive maintenance. ☐ Prepare a PM inspection checklist.		
4	B11	PREVENTATIVE MAINTENANCE	<u>SETTING UP A PREVENTATIVE MAINTENANCE PROGRAM</u> ☐ Describe the elements needed to establish a PM Program. ☐ Distinguish between a preventative and predictive maintenance.	Take pictures of preventative maintenance schedules within the workshop additionally, browse	Students will be required to create a P.M schedule of a workshop which will be scenario based.

			□ Prepare a PM inspection checklist.	the internet for PM schedules.	
5	B10	MATERIALS	<u>DISCUSSION</u> Methods used in the production of basic engineering materials and their uses (a) Ferrous materials and their alloys: (i) iron and steel; (ii) sources; (iii) production processes;	Conduct internet search about engineering materials.	Students will complete a quiz. This quiz will foster the engineering materials.
6	B10	MATERIALS	<u>DISCUSSION</u> Methods used in the production of basic engineering materials (a) diagrams and sketches of the production processes;	Conduct internet search about engineering materials.	Students will complete a quiz. This quiz will foster the engineering materials.
		MATERIALS	<u>DISCUSSION</u>		Students will complete a quiz. This quiz will

7	B10		Methods used in the production of basic engineering materials uses (a) properties; and, (B) uses.	Conduct internet search about engineering materials.	foster the engineering materials.
8	B10	MATERIALS	<u>DISCUSSION</u> Non-ferrous materials and their alloys: (i) aluminium; (ii) copper; (iii) lead; (iv) zinc; and, (v) brass:	Conduct internet search about engineering materials.	Students will demonstrate competency about engineering materials..
9	B1	SAFETY, HEALTH & WELFARE.	<u>DISCUSSION</u> <u>APPROPRIATE HEALTH AND SAFETY MATERIALS, TOOLS, EQUIPMENT, GEARS AND ACCESSORIES</u> □ Define safety materials, tools, equipment, gears and accessories. □ Identify the common safety gears tools equipment,	Students will view videos of various safety gears used in Mechanical Technology. Students will explain the procedures in operating an extinguisher.	Students will complete assigned activity of demonstrating the use of each safety gear and equipment.

			materials and accessories for safe use. ☐ Demonstrate the safe use of materials tools equipment and accessories ☐ Identify the different types of fires ☐ Operate and extinguisher.		
10	B1	SAFETY, HEALTH & WELFARE.	<u>DISCUSSION</u> <u>APPROPRIATE HEALTH AND SAFETY MATERIALS, TOOLS, EQUIPMENT, GEARS AND ACCESSORIES</u> <u>FIRST AID</u> ☐ Define accident injuries and emergencies.		

			☐ Describe how to get professional help in the event of an accident. ☐ Explain how to apply first aid on an injured person while waiting on professional help.		
11	B1	SAFETY, HEALTH & WELFARE.	<u>DISCUSSION</u> <u>APPROPRIATE HEALTH AND SAFETY MATERIALS, TOOLS, EQUIPMENT, GEARS AND ACCESSORIES</u> <u>SAFE AND HEALTHY WORKING ENVIRONMENT</u> ☐ Identify hazards safe work station waste disposal and hygienic practices.	Students will view videos of various safety requirements for Mechanical Technology.	Students will complete assigned activity for safety.

			□ Identify practices at the workstations/sites with reference to the following: A. Familiarity with the area. B. Knowledge of hazards. C. Maximization of resources. D. Proper cleaning and maintenance schedule. E. Suitable work and maintenance procedure / methods F. Storage and space utilization. G. Suitable behaviour patterns. H. Correct method of waste disposal. I. Rules regulation specification.		
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			J. Assessment and record recycling.		
12	B11	SAFETY, HEALTH & WELFARE.	<u>MAINTENANCE OF COMMON HAND TOOLS.</u> ☐ Maintain, clean and inspect common hand tools. ☐ Describe the correct operational uses for such tools.	Based on research, state the fundamentals of maintenance in industry.	Students will be evaluated based on a presentation. This presentation will state the fundamentals of maintenance in industry.
<i>FINAL EXAM</i>					

EASTER TERM: JANUARY - APRIL

Week	Module/Unit	Topics	Lesson/Method of Delivery	Use of ICT	Student Assessment
1			Building Construction Standards furniture design, materials and construction.		
2	B4	LAYOUT MEASUREMENT AND TESTING	<u>USE AND CARE OF HAND TOOLS</u> ☐ Use and care of measuring and layout tools in a safe way. ☐ Check for flatness and square-ness in a work piece. ☐ Measure round and hollow stock using callipers and micrometers. ☐ Measure and layout form datum.	Conduct an image search on the internet. Collect a picture demonstrating the use and care of hand tools.	Students will prepare an essay stating the use and care of hand tools.

			☐ Measure angles. Layout flat work.		
3	B4	LAYOUT MEASUREMENT AND TESTING	<u>USE AND CARE OF HAND TOOLS</u> ☐ Read simple blueprint drawings. ☐ Work to a tolerance of 0.1mm ☐ Make templates transfer design to work piece. ☐ Layout duplicate pieces and find centre of round stock. ☐ Inspect work for accuracy of dimension and form. ☐ Sharpen layout tools.	Use YouTube to watch videos about layout and measurement /Factors to be considered when laying out a work piece.	Students will demonstrate how to read blueprint drawings and how to create templates.

4	B3	BENCH WORK HAND TOOLS	<u>CUTTING AND FILING OF METALS</u> ☐ Use and care for bench tools used in sawing, chiselling and filing operation. ☐ Hold and clamp work in vice ☐ Cut work with hacksaw junior saw and power saw ☐ Cut thin wall tubing ☐ Cut corners on light and heavy gauge metals. ☐ Chip metal with cold chisel ☐ Shear metal in vice with flat chisel.	Conduct electronic search on the uses and care of Bench work Hand Tools.	Students will complete activity on bench work and hand tools.
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5			□ Cut groove with a cape or round nose chisel. □ Sharpen cold chisel. □ Identify and select appropriate files for a job. □ Flat file concave and convex surface. □ Cross file metals □ Draw file metals. □ Test surface for flatness and square-ness Polish metals <u>DRILLING</u>		
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			☐ State and apply safety precautions for drilling operations. ☐ Prepare metals for drilling. ☐ Select appropriate work holding devices. ☐ Drill holes in metals. ☐ Drill pilot holes. ☐ Drill countersink holes.		
6	B3	BENCH WORK HAND TOOLS	<u>SCREW CUTTING BY HANDS</u> ☐ State and apply safety precautions when cutting screws by hand.	Use YouTube to watch videos about Bench work Hand Tools/Factors to be	Students will demonstrate how to effectively carry out

7			☐ Identify and cut externals thread with dies. ☐ Cut pipe threads cut internal threads with tap. ☐ Select appropriate drill from tap drill tables or by calculation. ☐ Check threads. <u>ENGINEERING FASTENERS</u> ☐ Layout work for riveting. ☐ Rivet metals.	considered when using Hand Tools.	the following procedures: screw cutting by hands and how to work with engineering fasteners.
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			☐ Fasten materials with machine screws, nuts and bolts. ☐ Join metals by hard and soft soldering. ☐ Use wrenches.		
8	B2	MACHINE TOOLS	<u>DRILL PRESS</u> ☐ State and apply safety precautions to be observed when using a drill press. ☐ Oil and maintain the drill press. ☐ Identify drill parts and angles. ☐ Set up work in vice.	Conduct a research which entails the following topics ✓ DRILL PRESS ✓ POWER SAW ✓ BENCH WORK	Students will be provided with a quiz on the various machine tools.

9			☐ Calculate and select machine speeds and feeds. ☐ Layout work for drilling. ☐ Set up work for various clamps and fitting. ☐ Perform the following operation on the drill press. Ream, Counter Bore, Counter sink, Drilling and spot face. ☐ Fit and remove tapered shank drills. <u>POWER SAW</u> ☐ State and apply safety precautions to be observed when using a power saw.	✓ PEDESTAL GRINDER	
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10			☐ Identify the parts of a power saw. ☐ Set up speed and select speeds and feeds perform the following on the power saw square cutting angular cutting. <u>BENCH WORK PEDESTAL GRINDER</u> ☐ State and apply safety precautions to a bench pedestal grinder. ☐ Select appropriate speed for material being ground. ☐ Mount wheel in correct position. ☐ Dress wheel.		
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11	B2	MACHINE TOOLS	<u>THE CENTER LATHE</u> ☐ State safety precaution associated with the use of the center lathe. ☐ Apply safety precautions associated with the use of the center lathe. ☐ Locate and drill center hole on stock ☐ Identify tools bit types materials and angles. ☐ Set up tools bit for turning.		
12			☐ Check centers for alignment. ☐ Mount work between centers.	Conduct a research which entails the following topics ✓ THE CENTER LATHE ✓ DRILLING	

13			☐ Calculate and set machine speeds and feeds. ☐ Turn between centers. ☐ Identify grades of oils. ☐ Oil and maintain the lathe. ☐ Mount and dismount various chucks. ☐ Face work in chuck ☐ Calculate taper.	☒ THREAD CUTTING ☒ SPECIAL OPERATION ☒ BENCH AND PEDESTAL GRINDER ☒ POWER SAW. ☒ THE MILLING MACHINE ☒ SURFACE GRINDER	
14			☐ Cut taper using compound slide.	☒ SIMPLE THEORY OF CUTTING TOOLS	Students will be assigned varying topics, for each topic students should prepare a presentation.

15			□ Cut a shoulder and /or recess work in chuck. □ Turn work held in chuck supported by tail stock. □ Part off work piece. <u>DRILLING</u>		
16			□ Drill hole with tapered shank drill in tailstock. □ Drill with a straight shank bit held in a Jacob chuck. □ Ream with reamer held in tail stock. <u>THREAD CUTTING</u>		

			□ Use a hand book or tables to select gear train. □ Cut external thread using stock and die. □ Cut internal thread using tap. <u>SPECIAL OPERATION</u> □ Identify the face plate to be used for a work piece. □ Fit and cut work on a mandrel. □ Turn the work piece on a mandrel. □ Set up and turn work with fixed and travelling steadiness. □ Knurl work.		
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			☐ Counterbore work in lathe using a drill.		
<i>FINAL EXAM</i>					

SUMMER TERM: MAY - JULY

Week	Module/ Unit	Topics	Lesson/Method of Delivery	Use of ICT	Student Assessment
1			<u>BENCH AND PEDESTAL GRINDER</u> ☐ State and apply safety precautions to be observed when using a power saw. ☐ Select the appropriate wheel for material being ground. ☐ Mount wheel in correct position. ☐ Dress wheel.		

2			<u>POWER SAW</u> ☐ State and apply safety precautions to be observed when using a power saw. ☐ Identify the parts of the power saw. ☐ Set up work and select speed and feeds of the power saw ☐ Perform the following task on a power saw square cutting and angular cutting. <u>SPECIAL MACHINES</u> <u>THE MILLING MACHINE</u>		
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4			☐ State and apply appropriate safety precautions to be observed when using the milling machine. ☐ Oil and maintain milling machine. ☐ Select cutter for simple operation ☐ Calculate and select cutting speed for size of cutter and material of workpiece. ☐ Calculate and select rates of feeds ☐ Mount and dismount cutters on spindle ☐ Mount work in vice and check for parallelism.		
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5			☐ Adjust table for travel and depth cut ☐ Choose correct coolant and cutting fluids ☐ Surface mill work on horizontal/ vertical milling machine. ☐ Calculate for simple indexing		
6			<u>SURFACE GRINDER</u> ☐ List safety precaution associated with surface grinding ☐ List the steps involved for setting up on a machine table. ☐ Calculate speeds and feeds		

			☐ Select appropriate coolants <u>SIMPLE THEORY OF CUTTING TOOLS</u> ☐ List safety consideration in handling chip removal operation. ☐ Explain the function of rake and clearance angles for cutting different materials with different cutting tools. ☐ Explain the techniques of sharpening tools to control chips. ☐ Identify forces at tool points. ☐ List factor affecting the life of a cutting tool.		

<i>FINAL EXAM</i>

READING LIST:

PowerPoint Presentation (Google classroom)

Austin, Vincent. Workshop Theory. 1990, Macmillan Educational , London .

Bedford , John R. Metal Work Theory and Practice. 1990, John Murray, London.