INDUSTRIAL TECHNOLOGY

MECHANICAL ENGINEERING
LEVEL 8

Topic	Skills	Knowledge	Understanding	Attitude	Content	Method/ Strategies	Evaluation	Area of Integration
Holding Devices	1 Use various holding tools to clamp/hold workpieces. 2. Sketch holding devices.	1. Identify the types of holding tools. 2. State use of holding devices. 3. Describe various holding devices – G-clamps Mole grid wrench.	The use of various holding devices to perform operations such as, cutting, filing drilling.	Observe good safety practices associated with the use and care of holding devices.	Machine vice vee blocks and clamps. Mole grip wrench G-clamp.	Discussion on the use of holding devices. Demonstration on the proper uses of various holding devices. Sketching holding devices.	Students may be given oral and written questions related to the topic. Let students state the uses of specific holding devices. Let students describe various holding devices.	Wood Electricity

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Drills and Drilling	1. Use drilling machine to produce holes. 2. Select, remove, and replace drill bits. 3. Secure work for drilling.	1. Identify the various types of drilling machines. 2. Identify parts of the floor model drill press. 3. Identify parts of the twist drill and the two types.	1. The use of various types of drilling machines. 2. Functions of each part of the twist drill. 3. Materials used to make twist drills and use of the center punch before drilling.	Students must display safe working habits. Develop personal responsibility. Check to see that work is properly secured before drilling. Use the right drilling procedure.	Types of drilling machines- hand, portable, chest brace, press drill. Twist drills Drilling machine safety.	Discussion on the types and use of drilling machines and twist drills and their parts. Demonstration on the use of drilling machines. Drawing drills and label parts.	Examine the work done by students. Give written questions, to test understand-ing of concepts.	Woods Electricity

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Production of Iron		i. Explain method of production of iron. ii. State what is meant by sintering. iii. State the process of smelting.	Reasons for sintering Discuss how Iron ore is converted to iron. Contrast between slog and molten iron.	Accept the reasons given for sintering Aware of safety practices in the iron and steel industry.	The production of iron starts with the process of sintering i.e 1. Preheat to remove unwanted solid matter, moisture and carbon-dioxide and to produce pieces of ore suitable for smelting. 2. Refining the ore this process begins with smelting in the blast furnace.	Show video or slide pertaining to production of iron/steel. Show students an enlarged d view of a flow chart which includes the blast furnace.	Question students during the course of lesson . Let students explain in their own words the processes discussed. Paper and pencil test.	Reading

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Production of Steel					Furnace is charged with coke, iron ore and lime stone. Function of limestone and coke. Products of the blast furnace (eg pig-iron and slag).			

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Production of Steel		Explain method of production of steel. Identify the furnaces used. Explain the difference in quality of steel produced by each furnace.	Steel contains carbon in varying amounts. Steel can be made many times stronger than cast iron.	Will accept that steel companies produce a wide range of steel.	Beginning with Pig-iron containing 0.5 to 5.0% Carbon and other elements e.g. sulphur, silicon etc. Processes:- (a) Bessemer furnace its charged with pig-iron but only about 3% of steel is produced from this furnace . This furnace is replaced by the Basic Oxygen furnace.	Teacher explains difference between Iron and Steel - steel is on ally of iron and carbon. Teacher displays picture/diagrams of furnaces and give brief description of furnaces - bessemer -basic oxygen furnace.	Ask questions in reviewing lesson. Show students enlarged diagrams/pictures of furnaces for them to identify each by name paper and pencil test (short answers objective).	Integrated Science Reading

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			The difference in operation between the Bessemer and open-hearth furnaces.		(b) Open hearth or Sigmens Mertin. It''s first charged with lime stone then scrap steel about 90% of all steel is produced by this furnace.	Teacher explains advantages of open hearth furnace.	Assignments Paper and pencil test.	Integrated Science

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Cast Iron		Explain briefly the method of production of cast-iron. List the various kinds of cast-iron. Identify grey cast-iron from other types of cast-iron.	That : (i) fractured/broken grey cast-iron show a grandular structure. (ii) Parts subjected to horse conditions of service are made of steel **NOT** grey cast-iron.	Will appreciate the reason (s) given for the dark gray almost black appearance of freshly cut grey cast-iron. Students will be aware that small thin castings should not be dropped. It is easily broken and must be handled with care.	Producing Cast iron is: A smelting process. i The furnace used ii materials required (pig-iron, scrap, steel, coke, limestone etc) Slag and impurities appear. Quality of cast-iron is determined by the ratio of materials above.	Review production of pig-iron. Show students samples of cast-iron. Explain importance of grey cast iron. Characte ristics of gray cast-iron.	Review lesson by asking individual students specific question. Paper and pencil Test; Content extended response.	Reading Integrated Science

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Sketches of Design	Produce neat representative sketches of design in good proportion. Sketch in good proportion e.g. size of one part in relation to another.	Explain the reasons for making pictorial sketches of a product design simple projects to be constructed in workshop.	Sketching is the first phase in designing of a product. The basic rule when making a freehand sketch.	Participate in class/group discussion Accept that free hand sketches are useful.	Definition of design. Type of design (a) original b) improve-ment to an existing idea. Process of sketching (1) Using short light strokes.	Show students an original design of a project explain/discuss (involve students) how it could be improved. Sketch a simple project on chalkboard. Let students make the same sketch (project) using short, light strokes.	Performance test. Students to sketch a pictorial view of a given project.	Technical Drawing Building Technology.

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Working Drawing	Draw two or more views of project.	Prepare detailed drawings of each part of project.	The positioning of each view. - Front - Plan - End	Strive forwards the attainment of neatness of presentation.	Difference between first and third angle projections. Methods of dimensioning.	Use the said project to prepare a working drawing.	Prepare a working drawing of a project.	Technical Drawing Mathematics

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Planning Procedure	Write in sequential order an operation sheet for constructing a project.	Plan carefully for every item/project they (students) make.	As students plan their projects they will learn many of the same things done in industry.	Will accept that planning each manufactur-ing step will result in time serving.	Steps of procedure consist of : i. Writing brief statements of each task in a sequential order. ii. Listing correct tools/ equipment to carry out each task or operation.	Give students examples of an operation sheet. Teacher gives written example and discuss appropriate tools/equipm ent.	Assignment 1. Give students a given shape say a rectangle with specific dimensions. Let them state how they will find its center also marking off 4 equally spaced points along its center length. All tools to be stated.	Home Management English Building Technology

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Bill of Material.	Prepare a bill of materials.	Explain the procedure for preparing a bill of materials for constructing a project.	Importance of a bill of materials.	Appreciate the reasons discussed for having a bill of materials.	State the name of each part of project. Type of material to be used and cost of each part.	Show students CXC Plan Sheet which illustrates how Bill of Materials is prepared.	Similar exercise of bill of materials. Review lesson by questioning paper and pencil test.	Mathematics

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Hermaphrodite	1. Scribe lines parallel to (an edge) a datum. 2. Prepare a datum edge on metal.	1. Identify various types of odd-leg calipers. 2. Explain what is datum.	Laying out of work requires special tools.	Show awareness of care when using measuring and layout tools.	Hermaphro-dite sometimes called jenny caliper or odd-leg. It has two legs one pointed and the other is bent. i. Used to draw/scribe lines parallel to a datum (an edge). ii. Find center of circular work pieces also rectangular shape.	Explain to students with the aid of diagrams various types of odd-leg calipers and demonstrate its use. Let students carry out similar demonstrat-ion with scrap metal. Define the term datum and explain its importance and how it (datum) may be obtained.	Show students each tool. Call on individual student(s) to name a specific tool and explain its use. Assignment to:- Sketch the odd leg caliper. Explain the term datum and its importance.	Building Technology Technical Drawing

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Calipers	Measure internal diameters. Measure: (a) external diameter (b) Internal diameters Sketch each type of caliper and label the parts correctly.	Describe an inside caliper. Describe an (a) outside caliper (b) inside caliper State the use of each caliper.	Inside and outside calipers are used in conjunction with an engineer's rule. Circular stocks/ work pieces e.g. internal and external diameters are measured with calipers.	Students will be aware that calipers are used to transfer measure-ments and will take extreme care in so doing. Appreciate the importance of: accurate measure-ments handling of tools with extreme care.	Inside calipers their legs are curved outwards and they are used mainly to: i. measure internal diameters. ii. check internal faces are parallelism. Outside Caliper is a two legged steel instrument. Its legs are curved inward.	Show students how calipers are adjusted. Show students inside and outside calipers.	Paper and pencil test. Give students unlabelled diagrams of both calipers. Let them name both calipers and label the parts and state use. Let students: 1.Set calipers (outside and inside) to specific dimensions. Teacher will state dimensions.	

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					Outside calipers are used primarily to measure outside diameters and ensure that external surfaces are parallel.	Explain that there are two types i. firm joint ii.spring joint. Use large diagrams to i. Show parts of each type. ii. Use(s) of each caliper. Demonstrate and explain the use of each.	Measure round stocks external diameters and out this same activity for internal diameters.	

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Punches Prick and Centre Punches	Mark out center of work, dot punch center mark and enlarge with center punch.	Identify the difference between prick and center punch. Explain the specific use of i. prick punch ii. center punch.	Method of ensuring layout lines last longer on work pieces. Punches-prick and center- are not to be used on hard surface i.e. metal surfaces that are hardened.	Strive towards safe working practices. -personal and class mates- also use tools for their intended purpose.	Prick punch sometimes called Dot punch. It is made of hardened steel. The point is ground at an angle of 30º or 60º. Center punch is similar to prick punch except it has a large cross section and its point is ground to 90º.	Define the term punch. Explain the purpose of prick punch and center punch. Diagram to show students the difference between punches i.e prick and center punch.	Review topic by posing question to individual students. Give assignment. Let students demonstrate the use of each punch. Paper and pencil test: content objective and short answers.	Wood work Technical Drawing

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Surface Plate (Table)	Layout work on the surface table (plate).	State the use of a surface table.	That surface plate/table is a major piece of equipment in Mechanical Engineering Technology.	Willingly accept that surface table or plate must be used ONLY for laying out work.	Surface plate: A large iron or granite plate with a flat surface.	Explain to students. - purpose of table - describe the finish it has. -no hammering and why.		

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Vee-Block and Clamps	Set-up work using Vee-block and clamps.	Explain the use of the V-block and Clamps	That: Vee-block and clamps are useful accessories for - drilling operation - marking our..	Appreciate the importance and use of these support tools.	Vee-block and clamp are support tools in laying out. They hold and support work pieces. V-blocks are made of cast iron or steel. They are sold in pairs with clamps.	Display V-block and clamps. Show how they holds the stock. Students should be taken on tours to Mechanical work shop where they will observe these and other equipment in use.	Assignment 1. sketch 2. V-block clamps. Ask questions during lesson.	

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Angle Plates	Set up and (clamp) work securely to the angle plate.	Describe an angle plate and a surface plate. State the use of the surface plate and angle plate.	Work is held to the angle plate with bolts. The angle plate has holes through which the bolts pass.	They will use these tools with due care to avoid damage to the (support tools) working surfaces.	Plates are support devices in layout operations. Types of plates: - surface plate - Angle plate are used in conjunction with other layout tools.	Show students - surface plate.	Performance test i.e. students demonstrate use of equipment. Content: Objective and extended response Questions.	

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Combination Set	Use each part to perform operations namely - squaring work - checking and scribing angles - centering work.t	Identify the various components of the combination set. - squaring head - center head - protractor - ruler.	That each component of the combination set has a specific use.		Combination set consist of: - a rule and 3 heads namely - centre -protractor -square. The square has a scriber and a spirit level.	With the aid of diagram teacher shows students the combination set with each head labelled. Explain and illustrate the use of each head. - the square - checking squareness -measuring 45º and 90º.	Check - squareness of work. Set protractor to specific angle. Check - level of surface.	Woodwork

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Combination Square (Set)	Check squareness of work and measure/ check 45º angles using the com-bination.	1. Layout parallel and perpendicular lines.	Combination square consist of a blade which may be used in conjunction with any one of the three heads.	Students will be pleased for having the experience of using the tool as a square, protractor, or a guage-centre.	The combination square is used most often for: - measuring angles of 45º and 90º. -Checking squareness.		Students to demonstrate the use of each head. Note: Students must measure/ check 45 and 90 degree angles.	

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Surface Guage	i. Set scriber point accurately to specific height using the com-bination square rule. ii. Scribe layout lines.	Identify surface gauge and label the parts correctly.	The surface guage is used either to scribe layout lines or to measure heights.		Surface guage has - a flat heavy base - a spindle -a scriber -an adjusting screw	Explain and demonstrate use of each part. Students to sketch and label each part.	Students to name each part. Set scriber point to specific height.	

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Bevel Protractor	Mark layout lines on work at specific angles.	Read the protractor accurately. Set protractor to prescribed angles.	Bevel protractor makes it possible to layout or check an angle of any size.	Appreciate setting protractor accurately to the specific/ required degrees.	Bevel protractor consist of: - protractor head -steel rule	Demonstrate its use. Explain -advantage(s) -disadvantage(s) - how scale is read.	Students must set protractor to specific degrees.	Technical Drawing Math

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Colouring Metal for Laying Out	Apply layout fluid(s) on metal surfaces.	State - different types of layout fluids. - use of layout fluids. - fluids could be applied either by.	The reason(s) for metal surface to be coloured with layout fluid or chalk.	Will accept willingly that layout fluids ensure visability of layout lines.	Laying out fluids - different colour - clean surface of metal - applying fluid - brush on - spray on.	Show students samples of laying out fluid. Explain purpose of laying-out fluid. Use of chalk advantage and disadvantage.	Give students piece of material and ask them to apply layout fluid and layout lines at specific distance apart.	

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Non-Ferrous Metals	Select materials according to their physical properties.	Define non-ferrous metal. Define an alloy.	Non-ferrous metals, (unlike ferrous metal) do not contain iron.	Complete assigned tasks. Listen attentively and respond appropriately to questions.	Discussion on groups of non-ferrous metals: - Base metal - Alloys - precious metals.	Have discussion on non-ferrous metals and alloys.	Given written assignments.	Electricity Science English

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Production of Non-Ferrous Metals	Apply the concept of properties/ Character-istics whenever selecting materials for a project.	List types of non-ferrous metals and alloys.	Alloys are made in order to obtain materials which cannot be obtained otherwise.	Complete assigned tasks. Listen attentively and respond appropriately to questions.	Types of non-ferrous metals and alloys.	Discuss the various uses of non – ferrous metals and alloys.	Ask students questions during and after lesson to test students understand-ing.	Wood work Electricity

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Character-istics and Properties. Uses of Non-Ferrous Metals.	Character-istics whenever selecting materials for a project. Students will use metal and non-metal materials to make projects.	State the uses of non-ferrous metals and alloys. Identify non-ferrous materials Describe non-ferrous materials.	Alloys have a combination of properties not available in pure metal and to fulfill needs for which no pure metal can. The terms non-ferrous materials and non-metals.	Listening attentively and responding appropriately to questions.	Description of each type of non-ferrous metals -copper -aluminium -tin -zinc ,etc. Definition of : - non-ferrous materials. -non-metal eg. plastics.	Let students identify metals. Give examples of non-ferrous metals. Have discussion on non-ferrous materials and non-metal materials.	Give written assignments.	Electricity Woods Science English A

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Character-istics and Properties. Uses of Non-Ferrous Metals.	Prepare folders showing non-metal materials. Select materials appropriate for given jobs.	List types of non-ferrous metals and non-metal materials. State properties and characteristics of non-ferrous metal and non-metal materials e.g. plastics.	Two main grouping of non-ferrous metals are those used in their pure state and those that are made up of two or more metals.	Complete assigned work.	Definition of properties/ Characteris-tics. Discussion on properties/ Character-istics - colour - weight - fusibility - conductivity - corrosion - resistance.	Let students identify non-ferrous metal and non-metal materials. Give examples of non-ferrous metals and non-metal materials.	Ask questions during and after lesson to test understand-ing.	Wood work

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Character-istics and Properties. Uses of Non-Ferrous Metals.		Discuss properties and characteristics of non-ferrous metals and non-metal materials.	Non-metals include plastics, wood, and ceramics.		- Strength - Formability.	Have students identify metals and compare their properties and character-istics. Prepare short notes for students. Entertain questions during discussions. Let students prepare report/folder from observing the uses of materials in their homes, school and communities.	Paper and pencil test -Extended response -M.C.	Reading

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Non-Ferrous Alloys	Prepare report and other assignments on non-ferrous metals.	Types of non-ferrous metals and alloys. Identify types of non-ferrous metals and alloys. Discuss properties and characteristics of non-ferrous metals and alloys. Recognise the uses of non-ferrous metals in schools homes and communities.			Type of alloys -Brass -Bronza -Solder etc. (and their composition). Properties and characteristics -colour -weight -fusibility -formability, etc. Uses of each type of non-ferrous metals and alloys.	Have students identify metals and compare their properties and characteristics. Organise field trips/tours to e.g. Linmine,, Gafsons, Ind. Ltd. Prepare short notes for students. Let students prepare report/folder on types of non-ferrous metals.		

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Non Metal Materials. Introduction To Plastics.	Grasp Concept of non-metal materials e.g. plastics. Introduction to plastics.	Describe properties of plastics. Identify plastic articles. Select materials appropriate for given jobs.	Metals are useful to the individual, bit it is difficult to imagine life without plastic articles: for example, carpets, buckets, bowls, toothbrushes and toys are all made of plastics. List types of thermo plastic materials and thermo-setting plastics. State uses of plastics.	Complete assigned tasks.	Definition of plastics. Properties of plastics. Advantages and disadvantages of plastics. Two headings of plastics -thermo-plastic materials. -thermo-setting plastics.	Have discussion on plastics. Discuss the various uses of plastics. Let students identify plastic articles. Organise field trips/tours to industries for e.g. Gafsons, Ind. Ltd.	Give written assignments. Ask questions during and after lesson to test undertand-ing.	Electricity Woods Science Home-Economics Visual

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Commercial Forms and Supply Steels/ Metals.	Select appropriate shape of material for a given job or project.	Identify shapes and forms of iron and steel. List figures of shapes and forms of iron and steel. Discuss the processes of forging, hot rolling and cold rolling of iron and steel. Discuss uses of steel supplied to industries.	After iron and steel have been produced they find their way onto the market to be put to various uses. This involves shaping or changing them into suitable forms and shapes so that they will be useful for making a wide range of articles or components.	Listening attentively and responding appropriately to questions. Complete assigned work.	Forging of metals. Hot rolled metals. Cold rolled metals. The product ion of -bars -rods -tubes -sheets -wire -strips -black bars -bright bars etc. Picking of metals.	Have discussions on forging. Hot rolling and cold rolling. Have discussions on forms/ shapes of iron and steel . Let students identify shapes and forms of steel. Organise field trips and tours to industries for example.	Give written assignments. Ask questions during and after lesson to test students understand-ing.	Science