ELECTIVE MODULE FOR NORMAL (TECHNICAL) STUDENTS

Module Title	: Precision Engineering	Duration	: 24 hours
Pre-requisite	: Nil	Target Size	: 20 students per class

Aims of Module

- To expose students to a possible career in the Precision Engineering Industry by equipping students with hand on skills and knowledge required by the industry.
- To understand the safety precautions in operating the vertical milling machine and lathe machine.
- To foster an entrepreneur spirit amongst the students by manufacturing souvenirs to sell at school retail shop.

Learning Outcomes

At the end of the module, students will be able to:

- Apply skills and knowledge acquired in the precision engineering.
- Interpret technical drawings and assemble of machine parts component
- Manufacture components using the conventional machines (Milling & Lathe machines).
- Apply acquired skills and knowledge to produce different souvenirs to sell at school retail shop.

Module Outline

Students will be trained in fabricating precision engineering components using conventional milling and vertical machines.

Outline of Module Syllabus

Conventional Milling (10 hours)

- Interpret technical drawings and assemble of machine parts component
- Explain the safety precautions in operating the Vertical milling machine.
- Describe the types and applications of work holding devices used in milling machines.
- Mill components on a Vertical milling machine involving plain milling, drilling and reaming, slot milling, step milling, tapping and simple profile milling.
- Perform routine maintenance on the Vertical milling machines.
- Practical Assignments.

Conventional Turning (14 hours)

- Interpret technical drawings and assemble of machine parts component
- Explain the safety precautions in operating the Centre lathe machines.
- Describe the types and applications of work holding devices used in the Centre lathe,
- Turn components on a Centre lathe involving parallel turning, drilling, tapping, step turning, taper cutting and profile turning.
- Perform routine maintenance on the Centre lathe.
- Practical Assignment.

Item	Technical Skills/Knowledge	Instructional Hours T=Theory P=Practical
	Theory (include some practical demonstration and practices	
1	Interpret blueprints of milled components drawn in the first-angle orthographic projection. • State the purpose of an orthographic projection and briefly describe the method of projecting the 3 views. • Identify the 3 views in the first-angle orthographic projection: front view, side view and plan view. • Interpret the blueprints of simple engineering components in milling work drawn in first angle projection. • Interpret the blueprints of simple turned components drawn in the first-angle projection.	1.5 T 2 P
2	• State the importance of observing safety precautions when operating a milling and turning machine. • State the safety precautions to be observed when operating a milling machine with regard to: o Eye protection o Attire o Correct attitudes o Bad habits o Dangerous parts of the machine such as poor condition belts and pulley, gears, heavy accessories, cutters, and cutting tools. o Rotating chuck, drive plate o Rotating work o Flying chips, Long chips o Chuck key left in the chuck	1.5 T

2	• Discuss what should be done if an accident occurs in the workshop. • Explain the importance of proper lubrication and care of milling machines and carry out the maintenance procedure.		
3	• Identify the following engineering materials such as bright drawn mild steel, brass, aluminum, bronze, plastic sheet and use it to fabricate components for the project (milling & turning process). • Identify and use the suitable work holding devices such as clamp, swivel vice and fixture used in milling machines to do the project. • Identify cutters such as end mill, slot mill, form cutter that commonly used on the vertical milling machines to do the project. • State the relationship between the cutting speed, spindle speed and the size of cutters and select the correct spindle rpm for machining different materials used in the project. • Proper set up of tools and work in drilling, counter-boring, countersinking, and reaming on the milling machines to do the project.	0.5 T	7 T
4	• Identify and use the suitable work holding devices such as 3-jaws chuck, centers, etc used in turning machines to do the project. • Set up a component on a centre lathe using a 3-jaw chuck. • Set up a component between centres on a centre lathe. • Grind HSS lathe tools to the appropriate tool shapes and angles for facing, parallel turning, parting off and other various turning operations that required for the doing the project. • Polishing techniques on lathe. • Assemble the project.	0.5 T	11P

Assessment Criteria For the Practical Assignment

1 **Milling**

Students should be able to machine components within a dimensional tolerance of ISO IT 10 (0.1 mm) and a surface roughness between 1.6 to 3.2 microns (0.016 to 0.32 mm) using a milling machine. Assessment includes the following:

- Interpret blueprint of the mill work-piece.
- Handle the measuring equipment with care.
- Select the correct spindle speed and feeds.
- Set spindle speeds and feeds on the machine.
- Mill two perpendicular surfaces within a tolerance of ±30′.
- Mill two parallels surfaces within a dimensional tolerance of ISO IT 10 and surface
- Achieve roughness of between 1.6 to 3.2 microns.
- Check the dimensional accuracy with Vernier Caliper and Micrometers.
- Machine work-pieces to specifications by taking light trial cut, roughing cut and finishing cut.
- Observe safety precautions and good practices.

2 **Turning**

Students should be able to perform turning on a centre lathe, achieving a dimensional accuracy of ISO IT 10 (0.1 mm) and a surface roughness between 0.8 to 1.6 microns (0.008 to 0.016 mm). Assessment includes:

- Interpret blueprint of the turn work-piece.
- Handle the measuring equipment with care.
- Set up a work-piece in a chuck.
- Prepare the work-piece for various turning operations: facing, centre drilling, reaming, parallel turning, profile turning, taper turning etc.
- Grind a cutting tool to the appropriate tool shape shapes and angles for facing, parallel turning, parting off and other various turning operations.
- Set spindle speeds and feed for various turning operations.
- Machine work-pieces to specifications by taking light trial cut, roughing cut and finishing cut.
- Measure dimensions with Micrometer and Vernier Caliper.
- Observe safety precautions and good practices.

Completion Criterion

Students will be deemed to have successfully completed the module if they score the average marks of 50 for the 3 assessments. The guidelines for the assessments are given below.

	Assessment Component	Assessment Guidelines
(i)	Assessment 1 Blueprints Reading Exercise (20%)	Marks will be awarded for interpreting the Blueprint reading correctly.
(ii)	Assessment 2 Milling Project (40%)	Marks will be awarded for the criteria stated above.
(iii)	Assessment 3 Turning Project (40%)	Marks will be awarded for the criteria stated above.

Teaching and Learning Approaches

Based on the needs of the N(T) students, this elective course will consist of 20 hours practical training and 4 hours of theory lesson. The course emphasis on individual assessment and project works so that students' interest will be sustained through the lesson.

Completion Criterion

Students will be deemed to have successfully completed the module if they completed the project work and met the assessment criteria.

Target Audience

Sec 3 / 4 N(T) students.

Certification

ITE Certification of Attendance will be issued upon successful completion of the course.