GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-IV

Course Title: Marine workshop technology-II
(Course Code: 4341805)

Diploma programmer in which this course is offered	Semester in which offered
Marine Engineering	4th Semester

1. RATIONALE

This subject of Marine workshop technology-II provides knowledge and embeds skill to students to develop different products using various machining process. Manufacturing processes are the most important element in any engineering industry. Marine Engineer is a key person for shop floor activities related to marine instrument manufacturing. He/she should have knowledge and associated skill of machining processes to produce quality products at optimum cost. This course will make student familiar with fundamentals of cutting mechanics, kinematics, constructional features and selection criterion for various basic machine tools and automates with some basic exposure to conventional work holding devices and cutting tools and tool holders used on the same machines.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency.

- **Make a part/component as per given specification using appropriate machine tools, work holding devices, cutting tools & tool holders by employing optimum process parameters and safe working procedures.**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

CO-1	Calculate cutting parameters &its effects
CO-2	Demonstrate working of basic machine tools with kinematics.
CO-3	Select appropriate grinding processes, grinding machine, grinding wheels.
C0-4	Demonstration of CNC machines.
CO-5	Identify the machine tool, able to operate machine tool and select cutting parameters for given job.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
2	0	2	3	30*	70	25*	25	150

(*):Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

Legends: ***L****-Lecture;* ***T****– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***CA*** *- Continuous Assessment;* ***ESE*** *-End Semester Examination.*

5. SUGGESTED PRACTICAL EXERCISES

Following practical outcomes (PrOs) are the sub-components of the Course Outcomes (Cos). Some of the **PrOs** marked **'*'** are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	**Preparatory Activity:** For given work piece and tool material; select, set and observe cutting speed, feed and depth of cut on lathe machine. Also define these terms.	1	02
2	**Effect of Various Input Variables on Output variables during machining processes:** Demonstrate type of chips, surface finishes and tool life for varying cutting parameters for different work piece material and tool material. Tabulate the observations.	1	02
3	**Turning Job:** Prepare a job on center lathe as per the given drawing. (Including plain turning, step turning, taper turning, threading, knurling, grooving, Etc.) Student will also prepare report including: **a.** Drawing of the job. **b.** Operation sequences including details of cutting parameters used. **c.** Sketch of cutting tools used. **d.** Specification of machines used.	2	08
4	**Milling Job:** Prepare a simple job using milling operations including use of indexing head (Excluding gear tooth cutting). Student will also prepare report including: **a.** Drawing of the job(like hexagon, pentagon) **b.** Operation sequences including details of cutting parameters used. **c.** Specification of machines used. **d.** Machine settings for indexing.	3	06
5	**Shaping and Drilling Job:** Prepare a job having plain surfaces on shaping machine with minimum two holes as per given drawing. Student will also prepare report including: **a.** Drawing of the job. **b.** Operation sequences including details of cutting parameters used. **c.** Specification of machines used.	4 & 5	04
6	**Grinding Process** Prepare a job on Grinding machine (surface and cylindrical) as per the given drawing. (Suggestion: use same job as prepared in 4&5 for grinding operation of flat and cylindrical surface). Student will also prepare report including:	6	02

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	a. Drawing of the job. **b.** Specification of machines used. **c.** Grinding wheel used.		
7	**CNC operations** Prepare sample CNC program and Demonstration on CNC machine.	7	02
7	**Industrial Visit:** Visit a nearby machine shop and prepare a two page report comprises of list of machine tools including automates, its technical specification, machining parameters for various operations being performed, cutting tools and work holding devices used, observation of skill and safety criteria.	All	00
8	**Mini Project and Presentation:** For a given product (different for each student) prepare complete report in suggested format including selection of raw material type & section, sequence of various Machining operations, selection of machine, machining parameters, work holding device, tool , etc. For each machining operation. Each student will also present the outcome.	All	02
		Total	**28**

Note

i. *More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*
ii. *Care must be taken in assigning and assessing study report as it is a Second-year study report. Study report, data collection and analysis report must be assigned in a group. Teacher has to discuss about type of data (which and why) before group start their market survey.*

The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

Sr. No	Sample Performance Indicators for the PrOs	Weightage in %
1	Identify machine tools & their equipment's (Knowledge)	10
2	Able to operate, set the machine and select machining parameters. (Procedure followed)	20
3	Perform the experiment with accuracy. (Quality of job)	40
4	Follow safety practices. (Safety followed)	10
5	Submit the report. (Timely submission / Quality of report)	20
	Total	**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

These major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to user in uniformity of practical in all institutions across the state.

Sr. No	Equipment Name with Broad Specifications	PrO. No.
1.	Lathe with standard and special accessories.	2
2.	Milling machines-Vertical /horizontal with standard accessories and indexing/dividing head.	3
3.	Column drilling or Radial Drilling machine	4
4.	Shaper machine.	5
5.	Surface grinding machine	6
6.	Cylindrical grinding machine	6
7.	CNC trainer	7

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this course competency.

a) Work as a leader/a team member.
b) Follow safety practices.
c) Follow ethical practices
d) Maintain tools and equipment
e) Practice environment friendly methods and processes. (Environment related)

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit – I **Introduction**	1a. Explain mechanics of cutting.	1.1 Introduction of Machining Process used in industries & Safety
	1b. Explain the effect of varying cutting parameters.	1.2 Chip formation, types of chips. 1.3 Concept cutting parameter 1.4 Effect of cutting parameters on surface finish, tool life, economy, and mass production.
Unit – II **Lathe Machine**	2a. Explain classification, working principles, construction and operation of lathe 2b. Describe mechanism &	2.1 Define and classify basic machine tools. 2.2 Lathe machine. i. Working principle (using block diagram).

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
	motion transmission in lathe. 2c. Explain work holding& Tool holding devices for lathe	ii. Detailed specifications. 2.3 All geared head stock center lathe. i. Constructional features. ii. Kinematics (Drive, Feed mechanism, apron mechanism) constructional sketch, working, and application iii. Operations performed. iv. Work holding devices- (3 jaw chuck, 4 jaw chuck, face plate, centers). v. Thread cutting setting-concept methods. vi. Tapper turning Method
Unit – III **Milling Machine**	3a. Explain classification, working principles, construction and operation of milling machine. 3b. Describe mechanism & motion transmission in milling machine. 3c. Select appropriate Milling cutter for required milling operation.	3.1 Milling machine. i. Types.(Horizontal/Vertical) ii. Working principle (using block diagram). iii. Detailed sample specifications. 3.2 Construction & Operation. i. Constructional features. ii. Kinematics (drive, spindle speeds, feed mechanism, table movement, etc.) constructional sketch, working, and use. iii. Up milling and down milling 3.3 Milling cutters-types and applications. 3.4 Work holding devices- constructional sketch, working and applications. 3.5 Simple indexing methods.
Unit-VI **Drilling Machine**	4a. Explain classification, working principles, construction and operation of drilling machines. 4b. Select work & Tool holding devices for drilling machines.	4.1 Drilling machine. i. Types. ii. Working principle (using block diagram). iii. Detailed specifications. 4.2 Radial drilling machining. i. Constructional features. ii. Operations performed. iii. Work holding devices- constructional sketch, working and application iv. Tool holding and setting methods. 4.3 Metal removal rate (MRR) – concept.
Unit – V **Shaper & Planning**	5a. Explain types, working principles, construction and operations of shaping, and planning machines.	5.1 Shaping machine & Planning machine i. Working principle (using block diagram). ii. Constructional features and detailed

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Machines	5b. Select work & Tool holding devices for shaping and planning machines.	specifications. iii. Quick return mechanisms- kinematic sketch, working and advantages. iv. Work holding & tool holding devices.
Unit VI **Grinding processes.**	7.a Explain grinding process and its type 7.b Describe constructional features and working of various grinding machines 7.c Select proper grinding wheels for various grinding process	7.1 Describe grinding Process i. Definition ii. Basic Working Principle 7.2 Grinding Machine i. Classification and construction of grinding Machines (Surface, cylindrical, Centre less, tool & cutter grinding machine) ii. Basic Detail specification iii. Grinding Operations 7.3 Grinding wheel i. Abrasive grain ii. Bonding material iii. Nomenclature of grinding wheel iv. Selection and application of grinding wheel
Unit VII CNC machine	6a. Definitions & Principles 6b. Difference Between NC & CNC 6c. Types of turning center	6.1 Numerical control – definition components of NC systems – working principle of a CNC system distinguishing features of CNC Mach ines - advantage of CNC machines. 6.2 Difference between NC and CNC. 6.3 Types of turning Centre: horizontal, vertical.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Introduction	**2**	**2**	**2**	**0**	**4**
2	Lathe Machine	**5**	**3**	**4**	**7**	**14**
3	Milling Machine	**5**	**3**	**3**	**6**	**12**
4	Drilling Machine	**4**	**3**	**3**	**4**	**10**
5	Shaper & Planning Machines	**4**	**3**	**3**	**4**	**10**
6	Grinding processes	**4**	**2**	**5**	**3**	**10**
7	CNC machine	**4**	**2**	**3**	**5**	**10**
Total		**28**	**18**	**23**	**29**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

a) Select two industrial components (approved by teacher) and list various machine tools and operations used to produce these components.
b) Prepare a list of surrounded items which are prepared by machining processes.
c) Collect/download at least four different machine tool catalogues and make report of that with price.
d) List various machine tools (min. 5 machine) currently using in market for different operation to perform.
e) Identify the process use for re-sharpening different types of tools and prepare report for minimum 3 tools

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) To acquire knowledge of basic machine, tool and their operation arrange two or more **industrial visit** of production industry. After visit student must be submit their industrial visit report.
c) Guide student(s) in undertaking micro-projects.
d) ***'L' in section No. 4***means different types of teaching methods that are to be employed by teachers to develop the outcomes.
e) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-learning***, but to be assessed using different assessment methods.
f) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-projects are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration of the micro project should be about **14-16** ***(fourteen to sixteen) student engagement hours*** during the course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a) Prepare a small useful product like various machining parts assembly/v-block/ cutting tools/work holding devices/small laboratory equipment/set-up utilizing laboratory resources.
b) Using Drafting software, prepare machining products drawing with tolerances, quality measure.
c) Survey/Visit nearby vendor lathe, drilling, milling and shaper etc. machining process and prepare report on products manufacture.
d) Maintenance of available infrastructure related to.

13. SUGGESTED LEARNING RESOURCES

Sr. No	Title of Book	Author	Publication with place, year and ISBN
1	Machining and Machine Tools	A.B. Chattopadhyay	Wiley
2	Fundamentals of Machining Processes	Hassan Abdel-Gawad El-Hofy	CRC Press ISBN-13978-0849372889
3	Workshop Technology I & II	Raghuwanshi	Dhanpat Rai and Company(P) Limited
4	Production Technology (Manufacturing Process)	Dr. P C Sharma	S Chand
5	All about Machine Tools	HEINRICH GERLING	New Age International Private Limited
6	Production Technology	R. K. Jain and S. C. Gupta	Khanna Publishers
7	Elements of Workshop Technology Volume No. II Machine Tools	Hajra Choudhary, Bose S. K., Roy Nirjhar	Media promotors and publishers pvt. Limited
8	Production Technology	HMT	Tata Mcgraw-Hill Publishing Co.

14. SOFTWARE/LEARNING WEBSITES

i. http://nptel.iitm.ac.in/video.php?subjectId=112105126
ii. http://www.youtube.com/watch?v=H0AyVUfl8-k&list=PLEFE7D1579523C45D
iii. http://www.youtube.com/watch?v=FFzRIop5bpg&list=PL843C2A830C65E2EE
iv. http://www.youtube.com/watch?v=81Fdif5e85c
v. http://www.youtube.com/watch?v=A0dTvf_Q8BA&list=PL2C105C94D2955C8B
vi. http://www.youtube.com/watch?v=tDc0l9Gm8D4&list=PL3AFB507B668AF162
vii. http://www.youtube.com/watch?v=THVgkBnjLq0
viii. http://www.youtube.com/watch?v=6VpCBk7FahI
ix. http://www.youtube.com/watch?v=7wC1u4WOV1o
x. http://www.youtube.com/watch?v=VDIoUZuTunI
xi. http://www.youtube.com/watch?v=Mn9jpqI8rao
xii. http://www.youtube.com/watch?v=8SuoH5aL1SY
xiii. http://www.youtube.com/watch?v=xxNZSQML_ZA
xiv. http://www.youtube.com/watch?v=XXUHZxweBcw&list=PLD07DE61CB871A0CB
xv. https://nptel.ac.in/courses/110106146

xvi. https://www.youtube.com/watch?v=gcWj4OcteTk

15. PO-COMPETENCY-CO MAPPING

Semester IV	Marine workshop technology-II (4341805)						
	POs						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
Competency & Course Outcomes	Basic & Discipline specific knowledge	Problem Analysis	Design/ development of solutions	Engineering Tools, Experimentation & Testing	Engineering practices for society, sustainability & environment	Project Management	Life-long Learning
Competency	**Make a part/component as per given specification using appropriate machine tools, work holding devices, cutting tools & tool holders by employing optimum process parameters and safe working procedures.**						
CO 1. Calculate cutting parameters & its effects	3	3	2	2	--	--	--
CO 2. Demonstrate working of basic machine tools with kinematics.	3	--	--	2	--	--	--
CO 3. Select appropriate grinding processes, grinding machine, grinding wheels.	3	--	--	3	--	--	3
CO 4. Demonstration of NC and CNC machines.	3	--	--	3	2	2	2
CO 5. Identify the machine tool, able to operate and select cutting parameters for given job.	3	2	2	3	2	3	3

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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1.	I R Momin, Lecturer in Mechanical Engineering.	RCTI, AHMEDABAD	9586970802	Iqbal.momin786@gmail.com
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