GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Marine Workshop Technology – I
(Course Code: 4331802)

Diploma programme in which this course is offered	Semester in which offered
Marine Engineering	Third

1. RATIONALE

Different materials go into the making of a ship. Cast iron is one of the major materials uses in manufacturing ships. Many parts of ships are cast in foundry. Parts of ships are joined by welding. Different types of welding methods are used in ships. Lathes are used in ships for different purposes.

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.

- **Produce the job as per given specification by selecting and applying appropriate manufacturing processes like Casting, Forming, Joining, using 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:

a) To selecting suitable manufacturing processes to manufacture the products optimally.

b) To categories mental work and types of joints.

c) To evaluate principle of electric Arc Welding, Gas Welding and common Faults in Welded Joints.

d) To analyze process dynamics and performance of different manufacturing processes

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	
3	0	4	5	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

The following practical outcomes (PrOs) are the sub-components of the COs. These PrOs need to be attained to achieve COs. The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (Course Outcomes in psychomotor and affective domain) so that students are able to acquire the competencies (Programme outcomes). Following is the list of practical exercises for guidance.

Note: Here only course outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of Programme Outcomes/Course Outcomes in affective domain as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those programme outcomes/course outcomes related to affective domain.

S. No.	Unit Number	Practical/Exercise (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Hours
1	II	Prepare two jobs using hot forging/hot smithy process. This includes cutting of raw material and preparation of pre forgedparts.	06
2	II	Demonstration of spinning process with preparation of a job.	04
3	II	Visit a nearby Rolling mill/Hot-Cold material processes, allied manufacturing processes industry and prepare a two page report comprises of details(type, material, process, etc) of items produced, quantities, different sections, equipments used with specification, process parameters being used and consumables.	--
4	III	Demonstration of metal melting, metal pouring, metal castingand casting finishing. Also demonstrate and prepare a report on casting defects. (Use wax in place of molten metal for thepurpose of demonstration.)	04
5	III	Prepare a pattern drawing, pattern and core from the givencomponent/drawing.	06
6	III	Prepare a mould using prepared pattern, core and mouldingsand. Also pour molten metal and get the casting.	06

7	III	Visit a nearby foundry and prepare a two page report comprises of details (type, material, process, etc) of items produced, quantities, different sections, equipments used with specification, process parameters being used andconsumables.	--
8	IV	Prepare at least two jobs containing minimum 4 parts in eachusing arc welding. This includes cutting of raw material and preparation of pre-weld parts and use tacks and continuouswelding in each job.	08
9	IV	Prepare at least two jobs using gas cutting and gas welding. This includes cutting of raw material and preparation of pre-weld parts. Minimum 3 parts for each job should be taken andshould include tacks and continuous welding.	06
10	IV	Prepare a job using spot/seam resistance welding. This also includes cutting of raw material and preparation of pre-weldparts.	04
11	IV	Prepare two jobs, one using soldering and another using brazing. This also includes cutting of raw material and preparation of pre weld parts.	06
12	IV	Visit a nearby fabrication industry and prepare a two pagereport comprises of types of item produced, quantities, different sections, equipments used with specification and consumables.	--
13	ALL	SCHOOL WITHIN SCHOOL: Each student will present and will prepare report on: a. His/her observation for the jobs made. b. His/her experience during industrial visits. c. Process parameters and their effects.	06
		TOTAL	**56**

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.

S. No.	**Sample Performance Indicators for the PrOs**	**Weightage in %**
1.	Safety instructions	10
2.	Job sample drawing	10
3.	Selection of tool/equipment	20
4.	Sequence of operations and procedure	30
5.	Time limit	10
6.	Dimensional accuracy	10
7.	Oral test	10
Total		100

6. 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 cleanliness
e) Practice environment friendly methods and processes. (Environment related)

7. 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	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA Terminology)	Topics and Sub-topics
Unit – I Introduction to manufacturing processes	1.a Explain the basic manufacturing processes. 1.b Describe various mechanical propertiesinvolved.	1.1 Nature, role and scope of manufacturingprocesses. 1.2 Role of machining, forming, casting and joining processes in manufacturing of industrial components. 1.3 Recall mechanical properties of material.
Unit – II Metal working processes	2.a Compare the principles of hot and cold working Process. 2.b Identify and explain various metal working processes. 2.c Suggest appropriate metal working processand basic parameters for a given industrial component.	2.1 Concept, principles and differences of hotand cold working processes. 2.2 Classification of forming processes. 2.3 Rolling, Forging, Spinning, Drawing, Extrusion, Swaging. i. Types. ii. Working principle. iii. Equipments used and theirspecifications. iv. Major parts of equipments and their construction of materials andfunctions. v. Process parameters. vi. Applications.

Unit – III **Metal casting processes**	3.a Appreciate the needof casting process. 3.b Calculate pattern allowances. 3.c Interpret the standardcolor coding on pattern as well as core. 3.d Suggest appropriate casting method suitable for a given industrial component. 3.e Identify casting defects, their causes and suggest remedies.	3.1 Basic concept of foundry process. 3.2 Types of foundries. 3.3 Pattern: i. Importance. ii. Types and materials of construction. iii. Allowances, their need and normalvalues. iv. Drawings and color codes. v. Making process. vi. Applications. 3.4 Cores: i. Need. ii. Types. iii. Making materials and its properties. iv. Testing methods. v. Sintering. vi. Applications. 3.5 Types, working and applications of furnaces. 3.6 Molding sand: i. Sand properties. ii. Sand mixing. iii. Sand binders. 3.7 Molding equipments, their major Specifications and applications. 3.8 Types of mould, mould making, mould sintering and applications of mould. 3.9 Salvage techniques. 3.10 Recovery of sand. 3.11 Casting processes: basic principle, working, process parameters and applications. i. Centrifugal. ii. Die. iii. Investment. iv. Shell molding. 3.12 Casting defects -types, causes, effects and remedies. 3.13 Safety precautions in foundry.
Unit – IV **Non metal moulding processes**	4.a Suggest appropriate moulding method suitable for a given non metal industrial component.	4.1 Concept, basic principle, major parts, working and their materials of construction, process parameters and applications of: i. Injection moulding. ii. Blow moulding. iii. Extrusion process. 4.2 Safety precautions.

Unit – V Metal joining processes	5.a Appreciate the need of joining process to reduce cost and time. 5.b Explain different welding processes. 5.c Identify the area of applications of a particular joining process. 5.d Suggest appropriate process and process parameters based on given joining situation. 5.e Practice standard safety norms during any joining process.	5.1 Introduction and classification. 5.2 Welding: working principle, setup sketch, specifications of equipment and consumables, functions of each element, process parameters for various materials, applications and safety precautions for: i. Gas welding (Oxy-acetylene, Air-acetylene, oxy-hydrogen and LPG (Liquid Petroleum Gas)- oxygen. ii. Arc welding (Carbon arc, metal arc, MIG (Metal Inert Gas), TIG (Tungsten Inert Gas), flux coated arc and submerged arc). iii. Resistance welding (butt, spot, seam, projection and percussion). iv. Thermit welding. v. Forged welding. 5.3 Welding defects -types, causes, effects and remedies. 5.4 Working principle, setup sketch, specifications of equipment, tools and consumables, functions of each element, process parameters for various materials, applications and safety precautions for: Soldering and Brazing. 5.5 Adhesive joining - process, applications. 5.6 Fastening process - process, applications.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to manufacturing processes.	03	03	02	00	05
II	Metal working processes.	12	05	07	08	20
III	Metal casting processes.	12	05	07	08	20
IV	Non metal moulding processes.	03	02	03	00	05
V	Metal Joining Processes.	12	05	07	08	20
Total		**42**	**20**	**26**	**24**	**70**

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

Notes:

a. This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.
b. If midsem test is part of continuous evaluation, unit numbers I, II (2.1 and 2.2-only rolling, forging and spinning), III (Up to 3.6) and IV are to be considered. It is also compulsory for student to complete experiment.no.1 to 6 to eligible for midsem test.
c. Ask the questions from each topic as per marks weightage. Numerical questions are to be asked only if it is specified. Optional questions must be asked from the same topic.

9. 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:

Sr. No.	Activity.
1	Select four industrial components (approved by teacher) and list various methodsof manufacturing used to produce these components.
2	Select at least two components which are made by casting only. Also state the type of casting method used.
3	Prepare a list of household items which are prepared by joining processes.
4	Prepare a list of plastic items which are produced using different types of moldingmethods. Also name the process used.
5	Prepare a list of industries/workshops in the nearby area which are producingcomponents by machining, casting and forming.
6	Identify the type of manufacturing process used in making main component of acar engine.

10. 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:

Sr. No.	Unit	Unit Title	Strategies
1	I	Introduction to manufacturing processes.	Share the experience. Show various movies.
2	II	Metal working processes.	Demonstration. Movies. Live examples with suitable components. Industrial visits. Show effect of process parameters.
3	III	Metal casting processes.	
4	IV	Non metal casting processes.	
5	V	Metal Joining Processes.	

11. SUGGESTED LEARNING RESOURCES

Sr no.	Title of Books	Author	Publication
1.	Workshop Technology I & II	J. A. Schey	Tata MacGraw Hill Education
2.	Workshop Technology I & II	Raghuwanshi	Dhanpat Rai and Sons
3.	Workshop Technology I, II &	W. A. J. Chapman	Arnold
4.	Manufacturing Processes	M. L. Begman	Wiley India
5.	Production Technology	R.K. Jain and S.C. Gupta	Khanna publication
6.	Welding Engineering	B.E. Rossi	Jefferson Publications
7.	Audles Welding Guide	F.D. Graham	Wiley India
8.	Foundry Engineering	P.L. Jain	Tata MacGraw Hill Education
9.	Principle of Foundry	Jain & Gupta	National Book Trust, India
10.	Manufacturing Processes	S.E. Rusinoft	Times of India Press
11.	Production Technology	H.H. Marshall	Machinery Publishing Company

12. SOFTWARE/LEARNING WEBSITES

1. www.youtube.com/watch?v=k6iODHla6qY
2. http://web.iitd.ac.in/~pmpandey/MEL120_html/Metal%20Forming%20Processes
3. http://thelibraryofmanufacturing.com/forming_basics.html
4. http://www3.nd.edu/~manufact/MPEM%20pdf_files/Ch07.pdf
5. www.ielm.ust.hk/dfaculty/ajay/courses/ieem215/lecs/3_forming.pdf
   www.youtube.com/watch?v=HkjdMdp9KVU
6. http://www-old.me.gatech.edu/jonathan.colton/me4210/casting.pdf
   http://www.mccannsales.com/book/sandcasting.pdf
7. i:http://me.emu.edu.tr/me364/2.pdf
8. http://www.ielm.ust.hk/dfaculty/ajay/courses/ieem215/lecs/8_joining.pdf
9. http://www.tech.plym.ac.uk/sme/mats116/Materialsjoiningprocesseslecturenotes_docx.pdf
10. http://www.aws.org/w/a/
11. www.youtube.com/watch?v=H3Qb9I03FCk
12. www.youtube.com/watch?v=JqFp5kCeTA0
13. www.youtube.com/watch?v=7F0ypF6IdrU
14. http://www.flamingfurnace.com/
    http://www.sme.org
15. http://www.youtube.com/watch?v=IrcNSgLZuFs (Metal Casting)
16. http://www.youtube.com/watch?v=Yk1JOYzwRP4 (Loose piece Pattern)
    http://www.youtube.com/watch?v=khEvhjlh_SM (Foundry Pattern making)
17. http://www.youtube.com/watch?v=f7FXtnXVqzY (Aluminium Casting)
    http://www.youtube.com/watch?v=dOw624I9FDQ (Investment Casting)
    http://www.youtube.com/watch?v=bzSSfBgkWfc&NR=1&feature=endscreen (Hot Chamber Die Casting Process)
18. http://www.youtube.com/watch?v=Ul00-KoC1Oc (Shell Moulding)
19. http://www.youtube.com/watch?v=pTTap4WiEAU (Gravity Die Casting)
    http://www.youtube.com/watch?v=eUthHS3MTdA (Plastic Injection Moulding)
20. http://www.youtube.com/watch?v=6xnKmt_gsLs (Hot Rolling)
21. http://www.youtube.com/watch?v=9MU0vSN_w-A (Cold roll forming)cc:
    http://www.youtube.com/user/IGEJohannesen?feature=watch (Channel For welding videos)

22. http://www.youtube.com/watch?v=SDJdiNeDXto (Introduction to Welding)
23. http://www.youtube.com/watch?v=CJ42scaWFnw (Brazing video)

13. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

Sr.	Name and Designation	Institute	Contact No.	Email
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