GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Engineering Mechanics
(Course Code: 4335801)

Diploma programmes in which this course is offered	Semester in which offered
Printing Technology	Third

1. RATIONALE

The aim of this subject is to enhance the knowledge of machinery and equipment used in printing. Study of working characteristics will help in selection of proper machinery for effective printing. Skills developed by this course would also help in preventive and minor maintenance of machines for smooth functioning of printing shop. This course therefore is of a great importance for printing engineers.

2. COMPETENCY

The purpose of this course is to help the student to attain the following industry identified competency through various teaching-learning experiences:

Apply mechanical engineering fundamentals for smooth and efficient functioning of machinery in printing shop

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) Identify different material, mechanical hand tools, machine tools and components with their application.
b) Describe various power transmission systems and cam profile.
c) Understand metal casting and sheet metal working process.
d) Explain the application of air compressor, blower, valve and pump in printing industry.

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	-	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 the integration of Cos, and the remaining 20 marks is the average of 2 tests to be taken during the semester for 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 thesub-components of the COs.*Some of the **PrOs** marked **'*'** (in approx. Hrs column) are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomyrelated to 'Psychomotor Domain'*.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Explain the features and uses of various : i. Fasteners. ii. Belts. iii. Bearings. iv. Gears. v. Fitting tools. Students will prepare the report including following. a. Sketches. b. Specifications. c. Uses of above all.	I	02
2	a. Measure at least ten dimensions using vernier. b. Measure at least ten dimensions using micrometer.	I	02
3	a. Demonstrate functioning of various belt drives and rope drives. b. List various troubles in each drive. Also suggest remedies. (Solve at least two numerical related to belt drive.)	II	02
4	a. Show the functioning of chain and gear drive b. List various troubles in each drive. Also suggest remedies	II	02
5	Perform metal melting, metal pouring, metal casting and casting finishing processes. (Use wax in place of molten metal for the purpose of demonstration.)	III	02
6	Demonstration of Rolling (sheet metal working) process	III	02
7	Prepare one job having turning operation (facing, turning, taper turning, grooving, threading, knurling) operations.	IV	04
8	Prepare one job having milling operations.	IV	04
9	Prepare one job having drilling operations	IV	02
10	Show the functioning of Air Compressors used in Printing Industry.	V	02
11	Show the functioning of Blowers used in Printing Industry.	V	02
12	Show the functioning of different types of Valves used in Printing Industry.	V	02
	TOTAL		**28 Hrs.**

Note

i. *More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry-relevant skills/outcomes to match theCOs.The above table is only a suggestive list.*
ii. *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	Question and answers	20
2	Reorganization of Mechanical tools and equipments	20
3	Drawing skills	20
4	Use of different tools and equipments	20
5	Submission of assigned work	20
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

S. No.	Equipment Name with Broad Specifications	PrO.No.
1	Lathe Machine: Specifications: Centre height :200 mm Swing over bed: 400 mm Swing over cross slide: 245 mm Morse taper in spindle: MT4 Spindle Bore: 55 Power : 7.5 HP Length Of Bed: 5 ft	5
2	Milling Machine: Specifications: Max. height of the machine :1875 mm Max. length of the machine: 1850 mm Max. width of the machine: 1450mm Spindle diameter: 1.25” Table size: 38.4*9” Power :1.5 KW Motor: 2 hp	5
3	Drilling Machine: Specifications: Drilling capacity:25 mm No. of spindle speeds: 8 Max. distance of spindle to base:1100 Max. distance of spindle to work table: 770 Table Travel: 450	5

S. No.	Equipment Name with Broad Specifications	PrO.No.
	Table size: 315 *315 Column Height :1500mm Motor Recommended: 0.75KW(1 H.P.) 1440rpm	
4	Air Compressor: Maximum pressure 8 bars (120psi) tank size 24.5L (6.5 U.S. gallons) maximum displacement 50 liters/minute (1.8 cubic feet/minute)	6
5	Blowers: Centrifugal blower test rig Single phase 230 V	6
6	Pump: 1. Reciprocating Pump Test rig : Frequency 50 Hz Motor Power 2 HP 3 phase 2. Centrifugal Pump Test rig: Capacity : 35 Ltrs Pump Speed :1500 rpm Motor: 1 Hp dc motor 220 V AC	6
7	Filter	6
8	Valves	6
9	Tool kit	1
10	Belt drive ,Gear drive and Chain drive: Models of the above components	3
11	Cam	2
12	Bearing	1

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 competency.

a) Work as a leader/a team member.
b) Follow safety practices
c) Practice Good housekeeping
d) Follow ethical practices
e) Realize the importance of green energy.

The ADOs are best developed through 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. DETAILED COURSE CONTENTS

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

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
Unit – I Introduction	1a. Identify materials and hardware components. 1b. Explain use of fitting and measuring tools.	1a. Classification; properties and applications of various engineering materials. 1b. Types, sketches, specifications and uses of : i. Fasteners. ii. Belts. iii. Bearings. iv. Gears. 1c. Fitting tools and its types, sketches, material and applications. 1d. Measuring tools - vernier, micrometer.
Unit – II Power transmission	2a. Identify reasons for troubles and suggest remedies for troubleshooting in power transmission.	2.1 Methods of power transmission (belt, rope, chain, gear). 2.2 Associated terms, working principle, working and applications of above methods. 2.3 Applied simple calculations, common troubles and remedies of above methods.
	2b. Explain cams and cam profiles	2.4 Introduction, function and types of cams and cam followers. 2.5 Types of motions and displacement for different 2.6 Types of cam and cam followers. 2.7 Construction of different types of cam profile for given data.
Unit– III Metal casting and metal forming	3a. Describe casting process. 3b. Compare hot and cold working. 3c. Explain sheet metal working process.	3.1 Concept of foundry, pattern and core. 3.2 Ferrous and non-ferrous metal casting process. 3.3 Hot and cold working - definitions, differences, types and applications. 3.4 Sheet metal working - types and

		applications of processes.
Unit– IV Basic machine tools	4a. Select basic machine tools for making/repairing printing machine components.	4.1 Block diagram, 4.2 main parts, working, functions/uses of main parts, 4.3 Types of cutting tools used, accessories and their functions, 4.4 Types of processes which can be performed 4.5 Types of parts which can be produced, of machine tools: (i) Lathe. (ii) Milling. (iii) Drilling.
Unit– V Air compressors, blowers, pumps and valves	5a. Differentiate among various Types of Air Compressors & Blowers.	5.1 Types of air compressors and their uses. 5.2 Comparison of different air compressors. 5.3 Use of filters and moisture oil separator. 5.4 Types of blowers and their uses.
	5b. Explain functioning of various types of pumps and valves	5.5 Use of air compressors and blowers in printing industry. 5.6 Different types of pumps, their constructions and functions. 5.7 Use of pumps in printing industry. 5.8 Merit and limitations of different type of pumps. 5.9 Different types of valves, their construction and working 5.10 Application of valves in printing industry

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

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

Note*: This specification table provides general guidelines to assist studentsin their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to assess the attainment of theUOs. The actual distribution of marks at different taxonomy levels (of R, U, and A) in the question paper may varyslightly from above table.*

10. SUGGESTED STUDENT ACTIVITIES

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

i. Students will prepare Journal for the above mentioned Practical.
ii. List different mechanical components used in any one printing machine available in department.
iii. Identify various power transmission mechanisms on any one printing machine available in department. Also sketch them.
iv. List common troubles with their remedies for any one printing machine available in department.
v. Student will visit nearby printing press and prepare report on different power transmission system

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/subtopics.
b) Guide student(s) in undertaking micro-projects.
c) ***'L' in section No. 4***means different types of teaching methods that are to be employed by teachers to develop the outcomes.
d) 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 assessedusing different assessment methods.
e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
f) Students should be asked to visit some nearby big printing shop and study the different printing machines including pumps and valves etc in use. They should also discuss with the operators about frequent maintenance problems and possible solutions. Teachers should accompany them for better explanation.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her at the beginning of the semester. In the first four semesters, the micro-project 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 a dated work diary consisting of individual contributions 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 report on list of mechanical hand tools with its application you have used till now.
b) Prepare a list of gears used in printing machine available in your college laboratory.
c) Prepare a list of metals/material used in any one printing machine available in your college laboratory.
d) Visit any printing industry and collect data for mechanical equipments used there.
e) Prepare a report on cam and follower with its function used in printing machine available in your college laboratory.
f) Prepare a list of valves used in printing machine available in your college laboratory or in any printing industry you have visited.
g) Recognize the type of pump and list the application of its available in your college laboratory.
h) List the application of Air compressor for printing operation available in your college laboratory or in any printing industry.
i) Student will collect data of different supplier of mechanical parts and prepare a report on it

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with the place, year, and ISBN
1	S.S.Rattan	Theory of Machines	Fourth Tata McGraw Hill,2017,ISBN:9351343472,9789351343479
2	S. C. Rangwala	Engg. Materials	Charotar Publishing House,2008,ISBN: 8185594961,9788185594965
3	Hazara Chaudhary	Elements of Workshop Technology	Media Promoters and Publishers PVT.Ltd ISBN: 9788185099149
4	G.R.Nagpal	Machine Design	Khanna Publishers,1995,ISBN-13:978-81-7409-148-2
5	R.K.Bansal	Fluid Mechanics and Hydraulic Machines	Laxmi Publication ,2018,ISBN: 8131808157
6	Tyler and Hicks	Pump Operations and maintenance	McGraw Hill,2001,ISBN: 978-0070993495

14. SOFTWARE/LEARNING WEBSITES

i. unifledalloys.com
ii. Britannica.com
iii. fluidairedynamics.com
iv. gardnerdenver.com
v. acorn-ind.co.uk/insight
vi. fractory.com/mechanical-power-transmission

15. PO-COMPETENCY-CO MAPPING

Semester I	Text Generation (Course Code: 4325801)						
	POsR.C						
Competency & Course Outcomes	**PO 1 Basic & Discipline specific knowledge**	**PO 2 Problem analysis**	**PO 3 Design/ development of solutions**	**PO 4 Engineering Tools, Experimentation &Testing**	**PO 5 Engineering practices for society, sustainability & environment**	**PO 6 Project Management**	**PO 7 Life-long learning**
Competency .	**Apply mechanical engineering fundamentals for smooth and efficient functioning of machinery in printing shop**						
CO1. Identify different material, mechanical hand tools, machine tools and components with their application.	3	2	-	2	1	-	1
CO2. Describe various power transmission systems and cam profile.	3	2	-	2	1	-	1
CO3. Understand metal casting and sheet metal working process.	3	2	-	2	1	-	1
CO4. Explain the application of air compressor, blower, valve and pump in printing industry.	3	2	-	2	1	-	1

*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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NITTTR Resource Persons