GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: Basic Mechanical Engineering.

(Code: 3320602)

Diploma Programmes in which this course is offered	Semester in which offered
Civil Engineering,Environment Engineering	Second Semester

1. RATIONALE:

In the era of technology integration, it has become essential to possess the basic knowledge of various engineering disciplines. This course mainly encompasses the major areas of mechanical engineering which are being used by civil engineering diploma students and are required to perform tasks such as selection of hand tools, diesel generator sets, pumps, welding, cutting and material handling equipments used for various purposes. Such skills can be developed through the basic mechanical engineering. This course is designed in such a way that practical performed in this course will develop these basic skills to perform well in industry as well as in field work.

2. COMPETENCIES:

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies

- **Selection of tools and equipment as per task requirement**
- **Apply the knowledge of mechanical engineering in integrated tasks of civil engineering.**

3. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
0	1	2	3	0	0	20	30	50

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

Note: It is the responsibility of the institute heads that marks for **PA of theory** & **ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. DETAILED COURSE CONTENTS:

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I **Introduction**	1a. Identify mechanical related basic components and their uses.	1.1 Introduction of mechanical engineering. 1.2 Use of mechanical engineering : i: In day to day life. ii: Interdisciplinary use. 1.3 Items in general use- identification criteria, major types, specifications and uses : such as bolts, nuts, washers, bearings, bushes, belts, springs, levers, couplings, brakes, screws, rivets, keys, o' rings, oil seals, gears, pulleys, shafts, axles, etc. 1.4 Pipes and pipe fittings- Types, specifications and uses of pipes and pipe fittings. 1.5 Hand and power tools: i: Types, specifications and uses of spanners (such as fix, ring, box, pipe, allen, adjustable, etc.). ii: Types, specifications and uses of hand tools (such as pliers, screw drivers, saws, hammers, chisels, cutters, planes, etc.). Types, specifications and uses of power tools(drill, chipper, etc.)
Unit– II **Power Transmission & Safety**	2a. Describe the type of power transmission being used in electrical engineering	2.1 Power transmission: i. Importance. ii. Modes (belt drives, rope drives, chain drives and gear trains). iii. Types of belts. iv. Gear train-concept, transmission ratio. v. Applications.
	2b. Describe the different types of couplings used in electrical equipment	2.2 Types and applications of couplings in power transmission.
	2c. Follow general safety norms applicable to mechanical engineering equipment	2.3 Causes and remedies of general accidents in power transmission. 2.4 Safety norms to be followed for preventing accidents and damage in power transmission. 2.5 Safety norms to be followed in mechanical based industries / shop floors.
Unit– III **Welding and Gas Cutting**	3a. Explain different welding and gas cutting operations.	3.1 Welding and Gas Cutting i. Types of welding ii. Arc and gas welding equipment, accessories and consumables. iii. Types of work carried out by welding and gas cutting.

Unit	Major Learning Outcomes	Topics and Sub-topics
	3b. Make simple jobs by using arc and gas welding.	3.2 Welding and Gas Cutting Process i. Working setup of arc and gas welding. ii. Precautions and safety during arc and gas welding
Unit– IV **Internal Combustion Engines (I.C.Engines)**	4a. Explain working of internal combustion engines.	4.1 Internal combustion engines. i: Meaning. ii: Classification. 4.2 Working of petrol engine, diesel engine and gas engine. 4.3 Performance parameters.
	4b. Identify faults in a given IC engine and suggest remedies by using trouble- shooting charts	4.4 4.5 Main parts and functions. 4.6 Applications. Common troubles and remedies.
Unit– V **Hydraulic and Pneumatic devices**	5a. Explain different fluid properties	5.1 Concept of theory of fluid flow. 5.2 General properties of fluids.
	5b. Describe construction, working and applications of centrifugal and reciprocating pumps	5.3 Pump. i. Working principle. ii. Types. iii. Working of centrifugal and reciprocating pumps. iv. Performance parameters. v. Main parts of pumps and their functions. vi. Common troubles and remedies.
	5c. Explain working and applications of water turbines and air compressor	5.4 Water turbines-working principle, types and applications. 5.5 Common troubles and remedies of water turbine. 5.6 Air compressor. i. Working principle. ii. Types. iii. Performance parameters. iv. Applications.
	5d. Describe working and applications of other pneumatic/ hydro-pneumatic equipment	5.7 Other hydraulic/pneumatic/ hydro-pneumatic equipments. i. Principle of working-hydraulic lift, hydraulic pump, hydraulic power pack, hydraulic jack. ii. Applications of above equipments.
Unit – VI **Material Handling**	6a. Select proper material handling equipment for a given situation	6.1 Need of material handling. 6.2 Types, principle of working and applications of material handling equipments. i. Hoisting equipments. ii. Conveying equipments. iii. Surface & overhead equipments. iv. Earth moving machineries. v. Construction machineries.

Unit	Major Learning Outcomes	Topics and Sub-topics
		6.3 Criteria for selection of material handling equipments. 6.4 Factors affecting selection of material handling equipments. 6.5 Selection of suitable material handling equipment for the given situation.
	6b. Identify common troubles/problems in material handling equipments and list possible remedial measures.	6.6 Common troubles and remedies.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY):

Unit No.	Unit Title	TUTORIAL HOURS	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
I.	Introduction	2	NOT APPLICABLE			
II.	Power Transmission & Safety	3				
III.	Welding and gas cutting	3				
IV.	I.C. Engines	2				
V.	Hydraulic and pneumatic devices	3				
VI.	Material handling	1				

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

6. SUGGESTED LIST OF EXERCISES / PRACTICALS

The exercises /practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competencies. Following is the list of exercises/practical/experiments for guidance.

S. No.	Unit No.	Practical Exercise	Tutorial Hours	Approx Hours Reqrd
1	I	a: Study various mechanical items, hand tools and power tools listed in Unit 1. Note their specifications/ designations (as per BIS) and uses. b: Identify use of each item demonstrated and will prepare the report with sketch of each item along with specifications/ designations (as per BIS) and uses.	02	04
2	II	a: Study various power transmission methods including points stated in Unit 2. Explain concept and calculation of velocity/ transmission ratio for belt drives and gear trains. b: Prepare the report including sketches of power transmission systems studies with labeling of each part, their specifications and functions. c: Calculate the velocity ratio, diameters/number of tooth based on data given. This has to be included in report also.	03	06
3	III	a: Study arc and gas welding including points stated at unit number 3. b: Explain welding transformer settings for welding. c: Explain pressure settings for gas cuttings. d: Study use of welding and gas cutting consumables, accessories and safety items. e: Observe safety norms to be followed for welding and gas cutting. f: Prepare the report including : i. Sketches for welding and gas cutting setups. ii. Specifications, uses and sketches for welding accessories, consumables and safety items. g: Prepare one job using welding and one job using gas cutting.	03	06
4	IV	a: Identify parts and demonstrate strokes of petrol, diesel and gas engines. b: Explain classification of IC engine on models. c: Determine the effect of variation of load on fuel-consumption of an I.C. engine. Also locate the faults in a given I.C.engine and suggest remedial measures.	02	04

		d: Prepare the report including : a.Sketches for various parts of petrol, diesel and gas engines and will explain the functions of each. b.Explanation of working of petrol, diesel and gas engines. c. Workout various parameters like break power, indicated power, fuel consumption, etc..		
5	V	a: Explain concept of theory of fluid flow. b: Study properties of fluids. c: Classify, show various parts and explain their functions, also demonstrate working of: a.Various pumps. b.Various turbines. c.Various air compressors. d.Other hydraulic/pneumatic/ hydro-pneumatic equipments. d: Perform test on centrifugal pump. Also find fault and remedies for centrifugal pump. Work out important performance parameters. e: Study working of Air compressor. f: Prepare the report including : a.Sketches for various parts of pumps, turbines, air compressors and other hydraulic/pneumatic devices and will explain the functions of each. b.Explain working of various pumps, turbines, air compressors and other hydraulic and pneumatic devices. c. Workouts	03	06
6	VI	a: Explain concept / demonstrate working of various material handling equipments / devices listed in Unit number 6. Also explain / demonstrate working of main parts of each equipment / device. b: Prepare the report including : a.Sketches for various parts of various material handling equipments / devices . b.Explain working of various material handling equipments / devices.	01	02
		Total	**14**	**28**

NOTES:

1. It is compulsory to prepare log book of exercises. It is also required to get each exercise recorded in logbook, checked and duly dated signed by laboratory assistant/instructor and teacher.
2. Student activities are compulsory and are also required to be performed and noted in logbook.
3. Term work report includes log book and term work reports. Term work report must not include any photocopy/ies, printed manual/pages, lithos, etc. It must be hand written / hand drawn by student only.
4. For 20 marks practical ESE, students are to be assessed for competencies achieved. Students may be asked to:
   i. Presentation on given topic.
   ii. Identify and specify given items.
   iii. Answer short questions which are leading to test competencies developed.
   iv. Explain working with neat sketch and state applications of various equipments/devices/instruments/etc. from the syllabus.
   v. Start and operate given equipments/devices/instruments/etc. from the syllabus.

7. STUDENT ACTIVITIES:

S. No.	Details of activity.
1	Student will visit the civil site and carryout the following- a) Prepare the list of mechanical engineering related equipments/machineries used at that site. b) Observe and study concrete mixing process.
2	Student will observe the working of crane and will prepare the specifications of it.
3	Prepare the list of mechanical items surrounding to you.
4	Collect catalogue of various pumps and compare them. Also find suitable pump for specified head.
5	Collect catalogue of earth moving equipments and study their working.

8. SUGGESTED LEARNING RESOURCES:

A. List of Books.

S.No.	Title of Books	Author	Publication
1	Theory of Machines	R.S.Khurmi and J.K.Gupta	S.Chand
2	Hydraulic machines	Jagdish lal	Metropolitan Book Company
3	Elements of Workshop Technology (Vol. 1,2)	Hazara chaudhary	Asia Publishing House
4	Hydraulics	R.C.Patel	Acharya Book Depot
5	Pumps operation and maintenance	Tyler and Hicks	Tata McGraw-Hill
6	Material Handling equipments	M.Rundenko	Mir Publishers

B. List of Major Equipment/ Instrument.

- Various mechanical items, spanners, hand tools and power tools.
- Various power transmission devices.
- Welding transformers, welding accessories and consumables.
- Gas welding set up with all accessories and consumables.
- Gas cutting process set up with all accessories and consumables.
- Petrol engine test rig.
- Diesel engine test rig.
- Air compressor test rig.
- Water turbine / working model of water turbines.
- Centrifugal pump test rig.
- Models / working models of various material handling devices.

C. List of Software/Learning Websites: ---

- http://www.youtube.com/watch?v=1cFu2bkZ7Vw&feature=related (ic engine)
- http://www.youtube.com/watch?v=pCg1Ih_oVSA (pump)
- http://www.youtube.com/watch?v=V3aPHmZ97yM&feature=related (pump)
- http://www.youtube.com/watch?v=FENCiA-EfaA&feature=related (impeller)
- http://www.youtube.com/watch?v=TBdUcGYo7XA (gas turbine)
- http://www.youtube.com/watch?v=HzQPNpP55xQ (turbines)
- http://www.youtube.com/watch?v=A3ormYVZMXE (hy.lift)
- http://www.youtube.com/watch?v=FP05rYRI9JU&feature=related (hy.pump)
- http://homepages.cae.wisc.edu
- http://www.youtube.com/watch?v=E6_jw841vKE&feature=related (air compressor)
- http://www.youtube.com/watch?v=twM-GLUYQ-o&feature=related (belt drive)
- http://www.youtube.com/watch?feature=endscreen&v=gjUwJ1CJVq4&NR=1 (belt drive)
- http://www.youtube.com/watch?v=XunM7yUC06M&feature=related (gear drive)
- http://www.youtube.com/watch?v=ftdgB93QOD8&feature=related (gear box)

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. M.K.Shukla**, Lecturer in Mechanical Engineering, Sir Bhavsinhji Polytechnic Institute, Bhavnagar.

Co-ordinator and Faculty Member from NITTTR Bhopal

- **Dr. K.K.Jain,** Professor and Head; Dept. of Mechanical Engg,
- **Dr. A.K.Sarathe,** Associate Professor; Dept. of Mechanical Engg,