GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

**Competency-focused Outcome-based Green Curriculum-2023 (COGC-2023)**
Semester-IV

**Course Title: Fluid Mechanics and Hydraulic Machinery**
(Course Code: 4341903)

| Diploma program in which this course is offered | Semester in which offered |
|---|---|
| Mechanical Engineering | 4th Semester |

## 1. RATIONALE

The main objective of this course is to understand the fundamentals of fluid mechanics, such as fluid and flow properties, fluid behavior at rest and in motion, and fundamental equations like mass, momentum, and energy conservation of the fluid flow, thereby developing an understanding of fluid dynamics in a variety of fields. Applications of these fundamental equations have been highlighted for flow measurements. Hydraulic machinery is essential in converting hydraulic energy to mechanical energy and vice-versa. Hydraulic turbines are used to meet our day-to-day power demands. Also, different types of pumps are essential equipment in all industries. It also tried understanding hydraulic devices generally used in industries through the course.

## 2. COMPETENCY

The course content should be taught and implemented to develop different skills so that students can acquire the following competency.

- **Select, operate and maintain fluid machinery based on fluid laws and characteristics.**

## 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 | Identify fluid properties and their effect on the flow system. |
| CO-2 | Apply various laws of fluid mechanics to various real-life applications. |
| CO-3 | Estimate various flow losses to select suitable pipe as per the given situation. |
| CO-4 | Select a hydraulic machine for a particular application. |

## 4. TEACHING AND EXAMINATION SCHEME

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

**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 **POs** marked **'*'** are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to the 'Psychomotor Domain.'

| Sr. No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. Required |
|---|---|---|---|
| 01 | Demonstrate various fluid properties. | I | 02 |
| 02 | Measure pressure using pressure measurement devices. | II | 02 |
| 03 | Verify Bernoulli's theorem. | II | 02 |
| 04 | Measure fluid flow by Venturi meter and orifice meter. | II | 04 |
| 05 | Determine the hydraulic coefficients(Cc,Cv & Cd) of an orifice. | II | 02 |
| 06 | Measure fluid flow using Notch. | II | 02 |
| 07 | Estimate Reynold's number using the given test rig. | III | 02 |
| 08 | Determine major and minor head losses through a pipe. | III | 04 |
| 09 | Perform a test on the centrifugal pump test rig. | IV | 02 |
| 10 | Perform a test on the reciprocating pump test rig. | IV | 02 |
| 11 | Perform a test on a hydraulic turbine test rig. | IV | 02 |
| 12 | Demonstrate the use of different hydraulic devices. | IV | 02 |
| **Total (Hours)** | | **-** | **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 representative list**.**

II. Care must be taken in assigning and assessing the study report as it is a Second-year study report. The study report, data collection, and analysis report must be assigned to a group. A teacher has to discuss the type of data (which and why) before the group starts 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 % |
|---|---|---|
| **For Demonstration type PrOs (PrOs Number: 1& 12)** | | |
| 1 | Knowledge | 30 |
| 2 | Quality of Report | 30 |

| | | |
|---|---|---|
| 3 | Participation | 20 |
| 4 | Punctuality | 20 |
| **Total** | | **100** |
| **Experimentation/performance type PrOs (PrOs Number: 2,3,4,5,6,7,8,9,10 & 11)** | | |
| 1 | Knowledge | 20 |
| 2 | Procedure follows | 30 |
| 3 | Observation Skill | 20 |
| 4 | Conclusion/ Summary | 10 |
| 5 | Quality of Report | 10 |
| 6 | Punctuality | 10 |
| **Total** | | **100** |

**Sample rubrics Performance Indicators for the PrOs**

| **Demonstration type PrOs (PrOs Number 1 &12)** | | | | | |
|---|---|---|---|---|---|
| Criteria | **%** | **10** | **9-8** | **7-6** | **5** |
| Knowledge | 30% | Students give the correct answers 90% or more. | Students give the correct answers between 70-89%. | Student give the correct answers between 50-69%. | Student give the correct answers less than 50%. |
| Quality of Report | 30% | Neat Handwriting, figure, and table. Complete labeling of figure and table. | Only formatting is not proper (Location of figures/tables, use of pencil and scale). | A few required elements (labelling/ notations) are missing. | Several require elements (content in paragraph, labels, figures, tables) are missing. |
| Participation | 25% | Excellent focused attention in the exercise. | Moderately focused attention on exercise. | Focused limited attention in the exercise. | Participation is minimum. |
| Punctuality | 15% | Timely Submission. | Submission late by one laboratory. | Submission late by two laboratories. | Submission late by more than two laboratories. |

| **Experimentation/performance type PrOs (PrOs number 2,3,4,5,6,7,8,9,10 & 11)** | | | | | |
|---|---|---|---|---|---|
| **Criteria** | **%** | **10** | **9-8** | **7-6** | **5** |
| Knowledge | 20% | Student give the correct answers 90% or more. | Student give the correct answers between 70-89%. | Student give the correct answers between 50-69%. | Student give the correct answers less than 50%. |
| Procedure | 30% | Student | Student follow | Student follow all | Student follow |

| | | | | | |
|---|---|---|---|---|---|
| follows | | follow all the procedure with precaution in a logical order. | all the procedure with some precaution in a logical order. | the procedure without precaution in a logical order. | all the procedure without precaution in an illogical order. |
| Observation Skill | 20% | Excellent focused attention in the exercise. | Moderately focused attention on exercise. | Focused limited attention in the exercise. | Participation is minimum. |
| Conclusion/ Summary | 10% | Student concept is mostly clear. | Student concept is partly clear. | Student concept is somewhat clear. | Student concept is not clear. |
| Quality of Report | 10% | Neat Handwriting, figure, and table. Complete labeling of figure and table. | Only formatting is not proper (Location of figures/tables, use of pencil and scale). | A few required elements (labelling/ notations) are missing. | Several require elements (content in paragraph, labels, figures, tables) are missing. |
| Punctuality | 10% | Timely Submission. | Submission late by one laboratory. | Submission late by two laboratories. | Submission late by more than two laboratories. |

## 6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

| Sr. No. | Equipment Name | PrO. No. |
|---|---|---|
| 1. | Different manometers. | 02 |
| 2. | Hydraulic test rig compressing facility to verify Bernoulli's theorem, venturi meter, orifice meter, orifice, and major & minor losses through pipes. | 03, 04, 05, 06, 07, 08 |
| 3. | Centrifugal pump test rig. | 9 |
| 4. | Reciprocating pump test rig. | 10 |
| 5. | Hydraulic prime mover test rig. | 11 |
| 6. | Working model of hydraulic devices. | 12 |

## 7. AFFECTIVE DOMAIN OUTCOMES

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

a. Work as a leader/ 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 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

Based on the higher level UOs of Revised Bloom's taxonomy formulated for developing COs and competency, the primary underpinning theory is given below. If required, more such UOs could be included by the course teacher to focus on attaining COs and competency.

| Unit | Unit Outcomes (UOs) (4 to 6 UOs at different levels) | Topics and Sub-topics |
|---|---|---|
| Unit-I<br>Fluid and Fluid Properties | 1.a Explain the effect of fluid properties on a flow system | 1.1 Concept and classification of fluid.<br>1.2 Properties of fluid<br>i. Density<br>ii. Specific weight<br>iii. Specific volume<br>iv. Specific gravity<br>v. Viscosity<br>vi. Surface tension<br>vii. Cohesion & Adhesion<br>viii. Capillarity<br>ix. Bulk modulus of elasticity<br>x. Vapor Pressure<br>1.3 Simple numerical examples. |
| Unit-II<br>Fluid Mechanics and Flow Measurement | 2.a Explain Fluid Pressure and use the appropriate pressure measuring device.<br>2.b Identify the type of fluid flow patterns.<br>2.c Describe and use continuity equations for one-dimensional fluid flow situations.<br>2.d Explain and apply fluid equations in simple industrial situations.<br>2.e Select and use flow measuring devices based on a given | 2.1 Fluid pressure, Pressure head<br>2.2 Concept of vacuum, gauge, atmospheric, and absolute pressure.<br>2.3 Pascal's law and its applications.<br>2.4 Classification of pressure measuring devices.<br>2.5 Working and application of pressure measuring devices:<br>i. Simple manometers (Piezometer, U tube manometer and single column manometer)<br>ii. Differential manometers (U tube and inverted)<br>2.6 Fluid energy and its types.<br>2.7 Fluid flow |

| | | |
|---|---|---|
| | situation. | i. Continuity, momentum, and energy equation.<br>ii. Flow patterns.<br>iii. Types of fluid flow.<br>2.8 Bernoulli's theorem. (Without derivation) and its assumption, limitations, and application.<br>2.9 Flow measurement: Construction, working, and application of Pitot tube, Orifice, Venturimeter, and Orifice meter.<br>2.10 Hydraulic co-efficients and its measurement.<br>2.11 Concept of Notch and Weir (without derivation and numerical).<br>2.12 Concept of Impact of jet and its application (without derivation and numerical).<br>2.13 Simple numerical problems on all above. |
| Unit-III Flow Through Pipes | 3.a Understand various losses.<br>3.b Explain the water hammer and surge tank.<br>3.c Select the appropriate pipe based on a given situation. | 3.1 Introduction to pipe and pipe flow.<br>3.2 Major and minor losses.<br>3.3 Reynold's experiment, friction factor, Darcy's and Chezy's equations (without derivation), Moody's chart<br>3.4 Water hammer and cavitation, its cause, effect, and remedies.<br>3.5 Simple numerical examples. |
| Unit-IV Hydraulic Machines | 4.a Explain the construction and working of hydraulic pumps.<br>4.b Estimate performance parameters of a given centrifugal and reciprocating pump.<br>4.c Explain the construction and working of the hydraulic turbine.<br>4.d Explain the construction, working, and application of hydraulic devices. | 4.1 Concept, classification, and application of pumps.<br>4.2 Construction, working, and application of centrifugal pump.<br>i. Types of impeller and casings.<br>ii. Multistage.<br>iii. Priming.<br>iv. Minimum suction depth.<br>4.3 Construction, working, and application of reciprocating pump.<br>i. Single acting pump<br>ii. Double acting pump<br>iii. Air vessel<br>4.4 Numerical on a reciprocating and centrifugal pump.<br>4.5 Concept of gear pump and vane pump.<br>4.6 Layout and features of a hydroelectric power plant.<br>4.7 Classification, construction, working principle, and applications of turbines: |

| | | |
|---|---|---|
| | | i. Pelton turbine<br>ii. Francis turbine<br>iii. Kaplan turbine<br>4.8 Types, construction, and working of draft tubes.<br>4.9 Concept of hydraulic devices.<br>4.10 Construction, working, and application of:<br>i. Hydraulic press<br>ii. Hydraulic accumulator<br>iii. Hydraulic ram<br>iv. Hydraulic coupling<br>v. Hydraulic intensifier. |

## 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 |
| I | Fluid and Fluid Properties | 03 | 3 | 4 | - | 7 |
| II | Fluid Mechanics and Flow Measurement | 10 | 6 | 8 | 7 | 21 |
| III | Flow Through Pipes | 04 | 3 | 4 | 7 | 14 |
| IV | Hydraulic Machines | 11 | 8 | 6 | 14 | 28 |
| **Total** | | **28** | **20** | **22** | **28** | **70** |

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

## 10. SUGGESTED STUDENT ACTIVITIES

| Sr. No. | Activity. |
|---|---|
| 1. | Prepare a chart/presentation to select particular pressure measuring device for a particular application. |
| 2. | Prepare a chart/presentation for a selection criterion for flow-measuring devices. |
| 3. | Prepare a chart/presentation for a selection criterion for pipes and pipe sizes. |
| 4. | Prepare a chart/presentation to select a particular pump for a particular application. |
| 5. | Prepare a chart/presentation to select a particular hydraulic pump for a particular application. |
| 6. | Prepare a tabulated summary of the types of pipes available in the market. (Summary includes type, specification, size range, material, rate, and applications). |
| 7. | Identify any one hydraulic pump and one prime mover available in the market in a group of five students with detailed specifications and current prices. |
| 8. | Visit a nearby related industry and prepare a summary of hydro-pneumatic devices used and their specifications. |
| 9. | Select at least three problems on the manometer and prepare a report containing their solutions. |

| | |
|---|---|
| 10. | Select at least three problems on the manometer and prepare a report containing their solutions. |
| 11. | Select at least three problems regarding the continuity equation and prepare a report containing their solutions. |
| 12. | Select at least three problems regarding Bernoulli's equation, and p prepare a report containing their solutions. |
| 13. | Select at least five problems regarding discharge measurement and prepare a report containing their solutions. |
| 14. | Select at least three problems to determine major and minor losses and prepare a report containing their solutions. |
| 15. | Select at least two problems to type of flow (Based on Reynold's number) and prepare a report containing their solutions. |
| 16. | Select at least three problems to determine major and minor losses and prepare a report containing their solutions. |
| 17. | Select at least two problems to determine the power/efficiency of the Reciprocating and Centrifugal pump and prepare a report containing their solutions. |

## 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Fluid Mechanics and Hydraulic Machinery being a fundamental subject, teachers are expected to lay considerable stress on understanding the basic concepts, principles, and applications. For this purpose, teachers are expected to give simple problems in the classroom and provide tutorial exercises to develop the necessary knowledge for comprehending the basic concepts and principles. As far as possible, teaching the subject is supplemented by demonstrations and practical work in the laboratory.

These are sample strategies that the course teacher can use to accelerate the attainment of the various outcomes in this course.

| Unit | Unit Title | Strategies |
|---|---|---|
| I | Fluid and Fluid Properties | |
| II | Fluid Mechanics and Flow Measurement | ○ Real-life examples, Demonstration of natural systems, Movies/Animations, Numericals, Massive Open Online Courses (MOOCs). |
| III | Flow Through Pipes | ○ Real-life examples, Demonstration of natural systems, Movies/Animations, Numericals, Massive Open Online Courses (MOOCs). |
| IV | Hydraulic Machines | ○ Real-life examples, Demonstration of natural systems, Movies/Animations, Numericals, Massive Open Online Courses (MOOCs). |

## 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-projects are group-based (groups 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 must maintain a dated work diary consisting of individual contributions to the project work and give a seminar presentation 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 a micro-project by the end of the semester to develop the industry-oriented COs.

A representative 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 or using suggested student activity.

A representative list of micro-projects is given here. The concerned faculty could add similar micro-projects in any form (chart/presentation/report/model):

1. Compare the following liquids concerning their density (for the same mass, compare the volume) (1) Petrol (2) Water (3) Edible oil (4) Caster oil (5) Mercury.
2. Arrange the situations of $H_2O$ at atmospheric pressure in ascending order (with reason) concerning their density.

   (a) Ice at -10℃, (b) Water at 30℃, (c) Water at 100℃, (d) Dry and saturated Steam at 100℃
3. Arrange the situations of $H_2O$ at an atmospheric temperature in ascending order (with reason) concerning their density.

   (a) Water at atmospheric pressure, (b) Water at 10 bar, (c) Water at 40 bar
4. Compare the following liquids concerning their viscosity (for the same temperature, compare the velocity) (1) Petrol (2) Water (3) Edible oil (4) Caster oil (5) Mercury.
5. Calculate the water weight when your home's water tank is completely filled with water.
6. Calculate the water pressure at different Discharge points (different floors) based on the equation $p = \rho gh$ and explain the phenomena variation of pressure at different floors.
7. Observe the working of a Hydraulic Jack at any garage and relate it with Pascal's law.
8. Measure the fluid pressure of the suction and discharge pipe of the pump and convert it into absolute pressure.
9. Observe the discharge water condition from a pipe at the time of car washing with a nozzle and without a nozzle and explain the difference considering Bernoulli's equation.
10. Observe discharge water condition from a pipe at fully and partially opened cock/valve/tap and explain the difference considering the continuity equation.
11. Draw a line diagram of the water supply & distribution line of your hydraulic lab and indicate the source of major and minor losses in it.
12. Visit the manufacturer's website for hydraulic pumps, collect the catalog, and select a suitable pump for your home application.
13. Calculate the major loss occurring in your hydraulic lab's water supply and distribution lines.
14. Indicate all sources of minor losses occurring in your hydraulic lab's water supply and distribution lines and give possible solutions to minimize these losses.
15. Prepare a demonstration model of the hydroelectric power plant.
16. Prepare a demonstration model of the hydraulic devices.
17. Gather information on prime movers of different hydroelectric power plants in Gujarat.
18. Select a pump for a coolant recirculation in a lathe machine, garage pump for car washing, Bore well pump, pump at a service station, pump used in water coolers, or pump in a purified water filter system with justification.
19. Download/collect a catalogue of pump manufacturers like Kirloskar, Shakti, Jyoti, Lubi, KSB, Havells, etc., and compare their parameters.

20. Prepare a display chart of types of pipes based on material. size and applications.
21. Observe pressure gauges used by roadside tire workers, blood pressure measurement by doctors., and pressure gauges mounted on a turbine test rig and write a report on it.
22. Visit nearby shops to identify different PVC and GI pipe fittings. Collect manufacturing catalogues related to the same.
23. Prepare any non-Newtonian fluid and compare its characteristics with Newtonian fluid.

## 13. SUGGESTED LEARNING RESOURCES

| Sr. No. | Title of Book | Author | Publication |
|---|---|---|---|
| 1 | A Textbook of Fluid Mechanics & Hydraulic Machines | Dr. R.K.Bansal | Lakhsmi publication (P) Ltd |
| 2 | Hydraulic & Hydraulic Machines | R.C. Patel & A.D. Pandya | Acharya Book Depot |
| 3 | Fundamental of Fluid Mechanics (in SI units) | Dr. D.S. Kumar | Katson Pub. house |
| 4 | Fluid Mechanics, Fundamentals, and Applications | Yunus A. Cengel, John M. Cimbala | MC-Graw Hill, Higher Education |
| 5 | Hydraulics and Fluid Mechanics, Including Hydraulics Machines | Dr. P. N. Patel, Dr. S. M. Seth | Rajsons Publications Pvt., Ltd. |
| 6 | Fluid Mechanics and Hydraulic Machines | R. K. Rajput | S. Chand & Company Ltd. |

## 14. SOFTWARE/LEARNING WEBSITES

1. https://nptel.ac.in/courses/112105206
2. https://nptel.ac.in/courses/112104117
3. https://nptel.ac.in/courses/112103249
4. https://www.classcentral.com/course/youtube-fluid-mechanics-concept-derivation-videos-53034
5. https://fmc-nitk.vlabs.ac.in/fluid-machinery/exp/centrifugal-pump/index.html
6. https://me.iitp.ac.in/Virtual-Fluid-Laboratory/
7. https://eerc03-iiith.vlabs.ac.in/List%20of%20experiments.html
8. https://fm-nitk.vlabs.ac.in/List%20of%20experiments.html

## 15. PO-COMPETENCY-CO MAPPING

| Semester IV | Fluid Mechanics and Hydraulic Machinery (4341903) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 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/ developmentof solutions | Engineering Tools, Experimentation& Testing | Engineering practices for society, sustainability & environment | Project Management | Life-longLearning |
| Competency | Select, operate and maintain fluid machinery based on fluid laws and characteristics. | | | | | | |
| CO-1: Identify fluid properties and their effect on the flow system. | 3 | - | - | - | - | - | 3 |
| CO-2: Apply various laws of fluid mechanics to various real-life applications. | 2 | 3 | 2 | 3 | - | - | 3 |
| CO-3: Estimate various flow losses to select suitable pipe as per the given situation. | 2 | 3 | - | 2 | 2 | - | 2 |
| CO-4: Select a hydraulic machine for a particular application. | 2 | 3 | - | 3 | 3 | - | 2 |

**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)

| Sr. No. | Name and Designation | Institute | Contact No. | Email |
|---|---|---|---|---|
| 1. | Prof. Nisha Pandya | Government Polytechnic, Himatnagar | 9426352574 | nishacryo8@gmail.com |
| 2. | Prof. (Dr.) Mihir Patel | B. & B. Institute of Technology, Vallabh Vidyanagar | 9426033823 | mihireagle@yahoo.co.in |
| 3. | Prof. (Dr) Rakesh Bumataria | Government Polytechnic, Porbandar | 9924402808 | rakesh.bumataria@gmail.com |
| 4. | Prof. Sumeet Kotak | Government Polytechnic, Jamnagar | 9033906004 | sumeetp.kotak@gmail.com |

## 17 BOS Resource Persons

| Sr. No. | Name and Designation | Department | Contact No. | Email |
|---|---|---|---|---|
| 1. | Dr. S. H. Sundarani, BOS (Chairman HOD Mechanical Engg.) | Government Polytechnic Ahmadabad | 9227200147 | gpasiraj@gmail.com |
| 2. | Dr. Rakesh D. Patel (BOS Member, HOD Mechanical Engg.) | B. & B. Institute of Technology, Vallabh Vidyanagar | 9825523982 | rakeshgtu@gmail.com |
| 3. | Dr. Atul S. Shah (BOS Member, Principal) | B. V. Patel Institute of Technology, Bardoli | 7567421337 | Asshah97@yahoo.in |