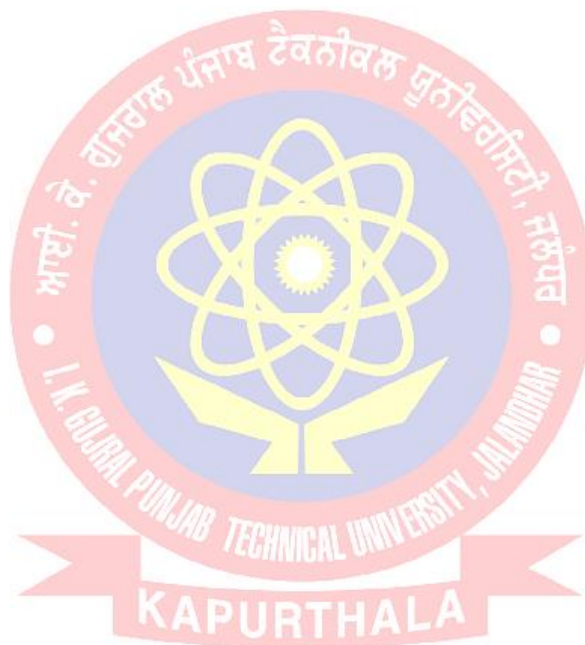


1.1.3 & 1.2.1

**Supporting Documents- Mechanical  
Engineering**

**Mapping of courses to employability/skill  
development**

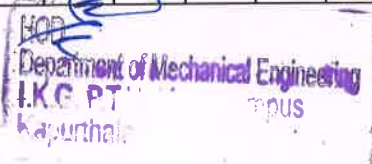


## Name of the Department: Mechanical Engineering

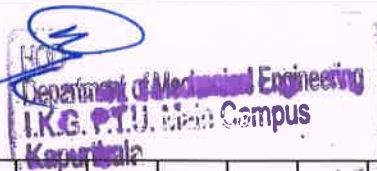
### BTPHXX-18 - Physics & Physics Lab

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO           |
|--|------|------|------|------|------|------|-----|-----|-----|------|------|------|---------------|---|--|
| CO1: To be able to understand the basic principles of Quantum mechanics and to apply these to the complex phenomenon of matter radiation interaction | ✓    |      | ✓    |      | ✓    |      | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exams |
| CO 2: To be able to understand the concept of wave packets using Heisenberg's uncertainty principle.   |      |      | ✓    |      | ✓    |      | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exams |
| CO 3: To be able to apply Schrodinger's wave equations to study the complex physical phenomenon.   |      |      | ✓    |      | ✓    |      | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exams |
| CO 4: To be able to understand the structure of crystalline solids by applying knowledge of crystallography.   |      |      | ✓    |      | ✓    |      | ✓   | ✓   |     | ✓    |      | ✓    | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exams |
| CO 5: To be able to understand semiconducting materials by using the concepts of band theory of solids.  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Applying      | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exams |

### BTAMXX-18 - Maths-1



| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO            |
|--|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|---------------|---|---|
| CO1: Students will be able to remember terminologies and formulae in matrices, complex     | √    |      | √    |      | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments, End Term Exams |
| CO2: Students will be able to understand and interpret the concepts of matrices, complex   |      |      | √    |      | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments, End Term Exams |
| CO3: Students will be able to compare and analyze the methods in matrices, complex numbers | √    | √    | √    | √    | √    | √    | √   | √   | √   | √     | √     | √     | Applying      | Yes                                       | Minor Exams, Buisness Quiz, Assignments, End Term Exams |



**BTEE101-18 Basic Electrical Engineering**

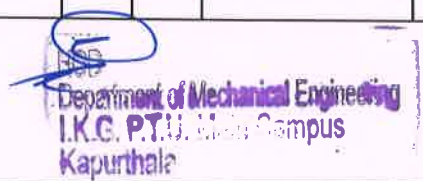
| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO            |
|--|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|---------------|---|---|
| CO1: Have the knowledge of DC circuits, AC Circuits, basic magnetic circuits, working principles of electrical machines, and components of low voltage | √    | √    | √    |      | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments, End Term Exams |
| CO 2: Be able to analyze of DC circuits, AC Circuits   |      | √    | √    |      | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments, End Term Exams |
| CO 3: Understand the basic magnetic circuits and apply it to the working of electrical machines  |      | √    | √    |      | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments, End Term Exams |

|   |  |   |   |  |   |  |   |   |  |   |  |   |  |               |     |  |
|---|--|---|---|--|---|--|---|---|--|---|--|---|--|---------------|-----|--|
| CO 4: Be introduced to types of wiring, batteries, and LT switchgear. |  | √ | √ |  | √ |  | √ | √ |  | √ |  | √ |  | Understanding | Yes | Minor Exams, Buisness Quiz, Assignments,End Term Exams |
|---|--|---|---|--|---|--|---|---|--|---|--|---|--|---------------|-----|--|

**BTEE101-18 Basic Electrical Engineering Lab**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO           |
|--|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|---------------|---|--|
| CO1: The ability to use common electrical measuring instruments and understand the fundamentals of electrical engineering. | √    | √    | √    |      | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exams |
| CO 2: The ability to make electrical connections, and measure power, power factor using appropriate equipments.            |      | √    | √    |      | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exams |
| CO 3: Have the knowledge of electrical machines, components and their ratings  |      | √    | √    |      | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exams |
| CO 4: Understand the operation of transformers and electrical machines   |      | √    | √    |      | √    |      | √   | √   |     | √     |       | √     | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exams |

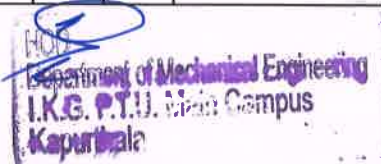
**Paper BTME101-18 Engineering Graphics & Design**



| Course Outcome | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|----------------|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|-------|---|--|
|----------------|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|-------|---|--|

|  |   |   |   |   |   |   |   |   |   |   |   |   |   |             |     |  |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|-------------|-----|--|
| CO1: design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety. | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | Design      | Yes | Minor Exams, Quiz, Assignments, Term Exams |
| CO 2: to prepare to communicate effectively.   | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | Communicate | Yes | Minor Exams, Quiz, Assignments, Term Exams |
| CO 3: to prepare to use the techniques, skills, and modern engineering tools necessary for engineering practice.   | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | Apply       | Yes | Minor Exams, Quiz, Assignments, Term Exams |

**BMPD101-18 Mentoring and professional Development**



| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO           |
|---|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|---------------|---|--|
| CO1: The student will be able to effectively communicate and present technical material.  | √    | √    | √    |      | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exam |
| CO2: Ability to think critically and creatively to generate innovative and optimum solutions.   |      | √    | √    |      | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exam |
| CO3: The student will be able to identify, evaluate and synthesise information from a range of sources to optimise process engineering design and |      | √    | √    |      | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exam |
| CO4: Engage in continuous education, training and research, and take control of their own learning and overall development.                       |      | √    | √    |      | √    |      | √   | √   |     | √     |       | √     | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exam |



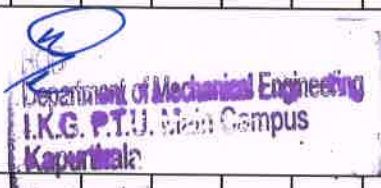
**BTCH101-18 - Chemistry -1**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO            |
|---|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|---------------|---|---|
| Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.  | ✓    |      | ✓    |      | ✓    |      | ✓   | ✓   | ✓   | ✓     | ✓     | ✓     | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| Rationalise bulk properties and processes using thermodynamic considerations.   |      |      | ✓    |      | ✓    |      | ✓   | ✓   | ✓   | ✓     | ✓     | ✓     | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques. |      |      | ✓    |      | ✓    |      | ✓   | ✓   | ✓   | ✓     | ✓     | ✓     | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.                        |      |      | ✓    |      | ✓    |      | ✓   | ✓   |     | ✓     |       | ✓     | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| List major chemical reactions that are used in the synthesis of molecules.  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   | ✓   | ✓   | ✓     | ✓     | ✓     | Applying      | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |

**BTCH102-18 - Chemistry Lab**


| Course Outcome | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|----------------|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|-------|---|--|
|----------------|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|-------|---|--|

|  |   |  |   |  |   |  |   |   |   |   |   |   |               |     |  |
|--|---|--|---|--|---|--|---|---|---|---|---|---|---------------|-----|--|
| Estimate rate constants of reactions from concentration of reactants/products as a function of time  | √ |  | √ |  | √ |  | √ | √ | √ | √ | √ | √ | Understanding | Yes | Minor Exams, Buisness Quiz, Assignments,End Term Exams |
| Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water. etc |   |  | √ |  | √ |  | √ | √ | √ | √ | √ | √ | Understanding | Yes | Minor Exams, Buisness Quiz, Assignments,End Term Exams |
| Synthesize a small drug molecule and analyse a salt sample   |   |  | √ |  | √ |  | √ | √ | √ | √ | √ | √ | Understanding | Yes | Minor Exams, Buisness Quiz, Assignments,End Term Exams |

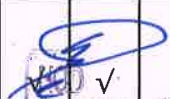


**BTAMXX-18 Mathematics II**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO           |
|---|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|---------------|---|--|
| CO1: The mathematical tools needed in evaluating multiple integrals and their usages.   | √    |      | √    | √    | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exams |
| CO 2: The effective mathematical tools for the solutions of differential equations that model physical processes.                 |      |      | √    | √    | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exams |
| CO 3: The tools of differentiation and integration of functions that are used in various techniques dealing engineering problems. |      |      | √    | √    | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exams |

**BTSPS101-18 Programming for Problem Solving**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO            |
|--|------|------|------|------|------|------|-----|-----|-----|------|------|------|---------------|---|---|
| To formulate simple algorithms for arithmetic and logical problems.  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| To translate the algorithms to programs (in C language).   |      | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| To test and execute the programs and correct syntax and logical errors.  |      | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| To implement conditional branching, iteration and recursion.   |      | ✓    | ✓    |      | ✓    | ✓    |     | ✓   |     | ✓    |      | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| To decompose a problem into functions and synthesize a complete program using divide and conquer approach.   |      | ✓    | ✓    |      | ✓    | ✓    |     | ✓   |     | ✓    |      | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| To use arrays, pointers and structures to formulate algorithms and programs.   |      | ✓    | ✓    |      | ✓    | ✓    |     | ✓   |     | ✓    |      | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.  |      | ✓    | ✓    |      | ✓    | ✓    |     | ✓   |     | ✓    |      | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration. |      | ✓    | ✓    |      | ✓    | ✓    |     | ✓   |     | ✓    |      | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |

  
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**BTSP102-18 Programming for Problem Solving Lab**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO            |
|---|------|------|------|------|------|------|-----|-----|-----|------|------|------|---------------|---|---|
| To formulate the algorithms for simple problems   | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| To translate given algorithms to a working and correct program  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| To be able to correct syntax errors as reported by the compilers  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| To be able to identify and correct logical errors encountered at run time                               | ✓    | ✓    | ✓    |      | ✓    | ✓    |     | ✓   |     | ✓    |      | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| To be able to write iterative as well as recursive programs   | ✓    | ✓    | ✓    |      | ✓    | ✓    |     | ✓   |     | ✓    |      | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| To be able to represent data in arrays, strings and structures and manipulate them through a program    | ✓    | ✓    | ✓    |      | ✓    | ✓    |     | ✓   |     | ✓    |      | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| To be able to declare pointers of different types and use them in defining self referential structures. | ✓    | ✓    | ✓    |      | ✓    | ✓    |     | ✓   |     | ✓    |      | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |

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Kapurthala

|   |   |   |   |  |   |   |  |   |  |   |  |   |  |               |     |  |
|---|---|---|---|--|---|---|--|---|--|---|--|---|--|---------------|-----|--|
| To be able to create, read and write to and from simple text files. | √ | √ | √ |  | √ | √ |  | √ |  | √ |  | √ |  | Understanding | Yes | Minor Exams, Buisness Quiz, Assignments,End Term Exams |
|---|---|---|---|--|---|---|--|---|--|---|--|---|--|---------------|-----|--|

**Paper BTMP 101-18 Workshop/Manufacturing Practices**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO                   |
|---|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|---------------|---|--|
| CO1: gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different | √    | √    | √    | √    | √    | √    | √   |     |     | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Project based learning Assignments,End Term Exams |
| CO 2: able to fabricate components with their own hands.  | √    | √    | √    | √    | √    | √    | √   |     |     | √     | √     | √     | Apply         | Yes                                       | Minor Exams, Project based learning Assignments,End Term Exams |
| CO 3: Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.           | √    | √    | √    | √    | √    | √    | √   |     |     | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Project based learning Assignments,End Term Exams |
| CO 4: By assembling different components, they will be able to produce small devices of their interest.   | √    | √    | √    | √    | √    | √    | √   |     |     | √     |       | √     | Apply         | Yes                                       | Minor Exams, Project based learning Assignments,End Term Exams |

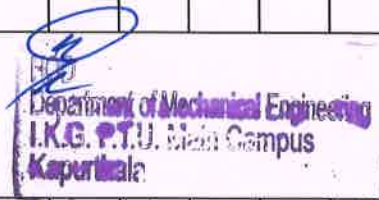


**Paper BTHU101-18 English**

| Course Outcome | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|----------------|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|-------|---|--|
|----------------|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|-------|---|--|

|   |   |   |   |   |   |   |   |  |  |  |   |   |   |               |     |  |
|---|---|---|---|---|---|---|---|--|--|--|---|---|---|---------------|-----|--|
| The objective of the course is to help the students become the independent users of English language.                               | √ | √ | √ | √ | √ | √ | √ |  |  |  | √ | √ | √ | Understanding | Yes | Minor Exams, Project based learn<br>Assignments,End Term Exams |
| Students will acquire basic proficiency in reading & listening, comprehension, writing and speaking skills.                         | √ | √ | √ | √ | √ | √ | √ |  |  |  | √ | √ | √ | Apply         | Yes | Minor Exams, Project based learn<br>Assignments,End Term Exams |
| Students will be able to understand spoken and written English language, particularly the language of their chosen technical field. | √ | √ | √ | √ | √ | √ | √ |  |  |  | √ | √ | √ | Understanding | Yes | Minor Exams, Project based learn<br>Assignments,End Term Exams |
| They will be able to converse fluently.   | √ | √ | √ | √ | √ | √ | √ |  |  |  | √ |   | √ | Apply         | Yes | Minor Exams, Project based learn<br>Assignments,End Term Exams |

**Paper BTHU102-18 English Lab**




| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |  |
|---|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|-------|---|--|--|
| The objective of the course is to help the students become the independent users of English language.                   | √    | √    | √    | √    | √    | √    | √   |     |     |       | √     | √     | √     | Understanding                             | Yes  | Minor Exams, Project based learn<br>Assignments,End Term Exams |
| Students will acquire basic proficiency in listening and speaking skills.   | √    | √    | √    | √    | √    | √    | √   |     |     |       | √     | √     | √     | Apply                                     | Yes  | Minor Exams, Project based learn<br>Assignments,End Term Exams |
| Students will be able to understand spoken English language, particularly the language of their chosen technical field. | √    | √    | √    | √    | √    | √    | √   |     |     |       | √     | √     | √     | Understanding                             | Yes  | Minor Exams, Project based learn<br>Assignments,End Term Exams |

|  |   |   |   |   |   |   |   |  |  |   |  |   |       |     |   |
|--|---|---|---|---|---|---|---|--|--|---|--|---|-------|-----|---|
| They will be able to converse fluently | √ | √ | √ | √ | √ | √ | √ |  |  | √ |  | √ | Apply | Yes | Minor Exams, Project based learning Assignments, End Term Exams |
|--|---|---|---|---|---|---|---|--|--|---|--|---|-------|-----|---|

**BMPD101-18 Mentoring and professional Development**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO            |
|---|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|---------------|---|---|
| CO1: The student will be able to effectively communicate and present technical material.  | √    | √    | √    |      | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| CO2: Ability to think critically and creatively to generate innovative and optimum solutions.   |      | √    | √    |      | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| CO3: The student will be able to identify, evaluate and synthesise information from a range of sources to optimise process engineering design and |      | √    | √    |      | √    |      | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| CO4: Engage in continuous education, training and research, and take control of their own learning and overall development.                       |      | √    | √    |      | √    |      | √   | √   |     | √     |       | √     | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |

  
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**Paper BTME301-18 Fluid Mechanics**

| Course Outcome | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|----------------|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|-------|---|--|
|----------------|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|-------|---|--|

|  |   |   |   |  |  |   |   |  |   |   |  |   |               |     |  |
|--|---|---|---|--|--|---|---|--|---|---|--|---|---------------|-----|--|
| CO1: Understand the concept of fluids and their properties.                              | √ | √ | √ |  |  | √ | √ |  | √ | √ |  | √ | Understanding | Yes | Minor Exams, Quiz, Assignments, Term Exams |
| CO 2:Apply the concept to solve the problems related to statics, dynamics and kinematics | √ | √ | √ |  |  | √ | √ |  | √ | √ |  | √ | Understanding | Yes | Minor Exams, Quiz, Assignments, Term Exams |
| CO3: Use and apply dimensional analysis and similitude techniques to various physical    | √ | √ | √ |  |  | √ | √ |  | √ | √ |  | √ | Understanding | Yes | Minor Exams, Quiz, Assignments, Term Exams |
| CO4: Distinguish various types of flows and learn flow measurement methods.              | √ | √ | √ |  |  | √ | √ |  | √ | √ |  | √ | Analyse       | Yes | Minor Exams, Quiz, Assignments, Term Exams |

**BTME302-18 Theory of Machines -1**



| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|-----|------|------|-------|-------|-------|---------------|---|--|
| CO1: Understand constructional and working features of important machine elements.          | √    | √    | √    | √    | √    | √    |     |      | √    |       | √     | √     | Understanding | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO2: Design belt, rope and chain drives for transmission of motion from one shaft to        | √    | √    | √    | √    | √    | √    |     |      | √    |       | √     | √     | Understanding | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO3: Identify different Cam and follower pairs for different applications and construct cam | √    | √    | √    | √    | √    | √    |     |      | √    |       | √     | √     | Understanding | Yes                                       | Minor Exams, Assignments, End Term Exams     |

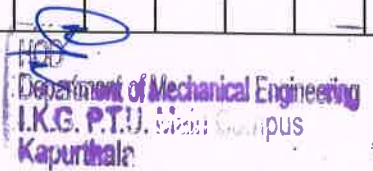


|   |   |   |   |   |   |   |  |  |   |   |   |  |                         |     |  |
|---|---|---|---|---|---|---|--|--|---|---|---|--|-------------------------|-----|--|
| CO4: Understand the function of brakes, dynamometers, flywheel and governors. | √ | √ | √ | √ | √ | √ |  |  | √ | √ | √ |  | Understanding, Applying | Yes | Minor Exams, Assignments, End Term Exams |
|---|---|---|---|---|---|---|--|--|---|---|---|--|-------------------------|-----|--|

**BTME303-18 : Machine Drawing**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO           |
|---|------|------|------|------|------|------|-----|------|------|-------|-------|-------|---------------|---|--|
| CO1: Read, draw and interpret the machine drawings and related parameters.        | √    | √    | √    |      |      |      |     |      |      | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Class and Home Assignments, End Term Exam |
| CO2: Use standards used in machine drawings of machine components and assemblies. | √    | √    | √    |      |      |      |     |      |      | √     | √     |       | Applying      | Yes                                       | Minor Exams, Class and Home Assignments, End Term Exam |
| CO3: Learn the concept of limits, fits and tolerances in various mating parts.    | √    | √    | √    |      |      |      |     |      |      | √     | √     |       | Understanding | Yes                                       | Minor Exams, Class and Home Assignments, End Term Exam |
| CO4: Visualize and generate different views of a component in the assembly.       | √    | √    | √    |      | √    |      |     |      |      | √     | √     | √     | Applying      | Yes                                       | Minor Exams, Class and Home Assignments, End Term Exam |
| CO5: Use CAD tools for making drawings of machine components and assemblies.      | √    | √    | √    |      | √    |      |     |      |      | √     | √     | √     | Applying      | Yes                                       | Minor Exams, Class and Home Assignments, End Term Exam |

**BTME304-18 STRENGTH OF MATERIALS-I**



| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                       | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------------|---|--|
| CO1: Understand the concepts of stress and strain at a point, in the members subjected to axial, bending, torsional loads and temperature changes.        | √    | √    | √    |      |      | √    |      |      | √    | √     | √     | √     | Understanding               | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO 2: Determine principal stresses, maximum shearing stress and their angles, and the stresses acting on any arbitrary plane within a structural element. | √    | √    | √    |      |      | √    |      |      | √    | √     | √     | √     | Understanding and Analysing | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO 3: Find bending moment and shear force over the span of various beams subjected to different kinds of loads.   | √    | √    | √    |      | √    | √    |      |      | √    | √     | √     | √     | Analysing                   | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO 4: Calculate load carrying capacity of columns and struts and their buckling strength.   | √    | √    | √    |      | √    | √    |      |      | √    | √     | √     | √     | Analysing                   | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO 5: Evaluate the slope and deflection of beams subjected to loads.  | √    | √    | √    |      | √    | √    |      |      | √    | √     | √     | √     | Analysing                   | Yes                                       | Minor Exams, Assignments, End Term Exams     |

**BTME305-18 Basic Electronics Engineering**



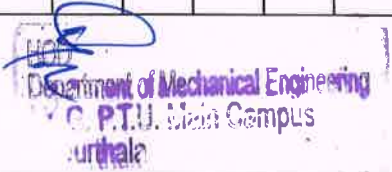
| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------|---|--|
| Understand construction of diodes and their rectifier applications. | √    | √    | √    |      |      | √    |      |      | √    | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Assignments, End Term Exams     |

|   |   |   |   |  |   |   |  |  |   |   |   |   |                             |     |  |
|---|---|---|---|--|---|---|--|--|---|---|---|---|-----------------------------|-----|--|
| Appreciate the construction and working bipolar junction transistors and MOSFETs. | √ | √ | √ |  | √ |   |  |  | √ | √ | √ | √ | Understanding and Analysing | Yes | Minor Exams, Assignments, End Term Exams |
| Design Op-Amp IC based fundamental applications.                                  | √ | √ | √ |  | √ | √ |  |  | √ | √ | √ | √ | Analysing                   | Yes | Minor Exams, Assignments, End Term Exams |

**Paper Basic Thermodynamics BTME 305-18**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO                         |
|--|------|------|------|------|------|-----|-----|-----|-----|------|------|------|---------------|---|--|
| CO1: Apply energy balance to Systems and Control Volumes in situations involving heat and work interactions. | √    | √    | √    |      | √    |     | √   | √   | √   | √    | √    |      | Applying      | Yes                                       | Minor Exams, Quiz, demonstration through videos/ lab, End Term Exams |
| CO2: Evaluate changes in thermodynamic properties of substances  |      | √    | √    | √    | √    |     |     |     | √   |      | √    | √    | Applying      | Yes                                       | Minor Exams, Quiz, demonstration through videos/ lab, End Term Exams |
| CO3: Evaluate performance of energy conversion devices   |      | √    | √    | √    | √    |     |     |     | √   |      | √    | √    | Applying      | Yes                                       | Minor Exams, Quiz, demonstration through videos/ lab, End Term Exams |
| CO4: Explain and apply various gas power and vapor power cycles  |      | √    | √    | √    | √    | √   |     |     | √   | √    | √    |      | Understanding | Yes                                       | Minor Exams, Quiz, demonstration through videos/ lab, End Term Exams |

**BTME306-18 Strength of Material Lab**



| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                       | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------------|---|--|
| CO1: Measure the various mechanical properties such as tensile and compressive strength, impact strength, torsion strength and fatigue strength and hardness | √    | √    | √    | √    |      | √    |      |      | √    | √     | √     | √     | Understanding               | Yes                                       | Quiz, Viva                                   |
| CO 2: Calculate load carrying capacity of long columns and their buckling strength.  | √    | √    | √    | √    |      | √    |      |      | √    | √     | √     | √     | Understanding and Analysing | Yes                                       | Quiz, Viva                                   |

### BTME307-18 Theory of Machines Lab

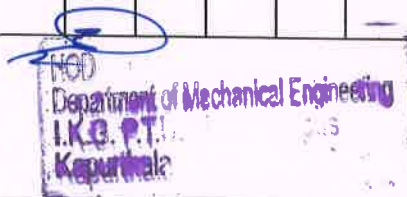
| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|-----|------|------|-------|-------|-------|---------------|---|--|
| CO1: Understand constructional and working features of important machine elements.          | √    | √    | √    | √    | √    | √    |     |      | √    |       | √     | √     | Understanding | Yes                                       | Minor Exams, Assignments, End Exams          |
| CO2: Design belt, rope and chain drives for transmission of motion from one shaft to        |      |      |      |      |      |      |     |      |      |       |       |       |               |   |  |
| another   | √    | √    | √    | √    | √    | √    |     |      | √    |       | √     | √     | Designing     | Yes                                       | Minor Exams, Assignments, End Exams          |
| CO3: Identify different Cam and follower pairs for different applications and construct cam |      |      |      |      |      |      |     |      |      |       |       |       |               |   |  |

|   |   |   |   |   |   |   |  |  |  |   |  |   |   |                         |     |  |
|---|---|---|---|---|---|---|--|--|--|---|--|---|---|-------------------------|-----|--|
| profile for required follower motion.   | √ | √ | √ | √ | √ | √ |  |  |  | √ |  | √ | √ | Designing               | Yes | Minor Exams, Assignments, End Term Exams |
| CO4: Understand the function of brakes, dynamometers, flywheel and governors. | √ | √ | √ | √ | √ | √ |  |  |  | √ |  | √ | √ | Understanding, Applying | Yes | Minor Exams, Assignments, End Term Exams |

**Paper BTME308-18 Fluid Mechanics Lab**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO           |
|--|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|---------------|---|--|
| CO1: Distinguish various type of flows and flow measurement methods and concept of         |      |      |      |      |      |      |     |     |     |       |       |       |               |   |  |
| statics and dynamics of liquids.   | √    |      |      |      | √    |      | √   |     | √   | √     |       | √     | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exams |
| CO 2: Determine discharge and head loss, hydraulic and friction coefficient, for different |      |      |      |      |      |      |     |     |     |       |       |       |               |   |  |
| types of flow in pipe and open channels.   |      |      |      |      |      |      | √   |     | √   | √     |       | √     | Analyse       | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exams |

**BMPD301-18 Mentoring and professional Development**





| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO            |
|---|------|------|------|------|------|------|-----|-----|-----|------|------|------|---------------|---|---|
| CO1: The student will be able to effectively communicate and present technical material.  | ✓    | ✓    | ✓    |      | ✓    |      | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| CO2: Ability to think critically and creatively to generate innovative and optimum solutions.   |      | ✓    | ✓    |      | ✓    |      | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| CO3: The student will be able to identify, evaluate and synthesise information from a range of sources to optimise process engineering design and |      | ✓    | ✓    |      | ✓    |      | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| CO4: Engage in continuous education, training and research, and take control of their own learning and overall development.                       |      | ✓    | ✓    |      | ✓    |      | ✓   | ✓   |     | ✓    |      | ✓    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |

### BTME401-18 APPLIED THERMODYNAMICS

Department of Mechanical Engineering  
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Kapurthala

| Course Outcome  | PO 1 (Engineering) | PO 2 (Problem) | PO 3 (Design/De) | PO 4 (Conduct) | PO 5 (Modern) | PO 6 (Thermal Engi) | PO 7 (Environment) | PO8 (Ethics) | PO 9 (Individual) | PO 10 (Communication) | PO 11 (Project Management) | PO 12 (Life long) | Skill                                 | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|--------------------|----------------|------------------|----------------|---------------|---------------------|--------------------|--------------|-------------------|-----------------------|----------------------------|-------------------|---------------------------------------|---|--|
| CO1: Explain the functioning and performance evaluation of reciprocating air compressors. | ✓                  |                | ✓                | ✓              | ✓             | ✓                   | ✓                  |              | ✓                 | ✓                     |                            | ✓                 | Understanding, Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO 2: Analyze the combustion phenomenon in boilers and I.C. engines.                      | ✓                  | ✓              |                  | ✓              | ✓             | ✓                   | ✓                  | ✓            | ✓                 | ✓                     | ✓                          | ✓                 | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Term Exams     |

|  |   |   |   |   |   |   |   |   |   |   |   |   |   |                         |     |                                     |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|-------------------------|-----|-------------------------------------|
| CO 3: Use of Steam Tables and Mollier Chart to solve vapour power cycle problems.                                  | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Understanding, Applying | Yes | Minor Exams, Assignments, End Exams |
| CO 4: Demonstrate the constructional features and working of steam power plants and to evaluate their performance. | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |   | ✓ | ✓ | ✓ | ✓ | Understanding, Applying | Yes | Minor Exams, Assignments, End Exams |

**Paper BTME 402-18 Fluid Machines**

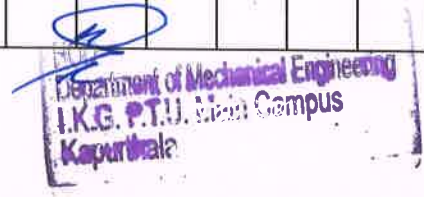
| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill     | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO                               |
|---|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|-----------|---|--|
| CO1: Determine discharge and head loss, hydraulic and friction coefficient, for different types of flow in pipe and open channels.                                    | ✓    | ✓    | ✓    |      |      | ✓    | ✓   |     |     | ✓     |       | ✓     | Knowledge | Yes                                       | Lectures, Tutorials, Assignments, Powerpoint Presentations, Numerical etc. |
| CO 2: Know about constructional details, working and design aspects of runner/wheel and evaluate the performance of various turbines like Pelton, Kaplan and Francis. | ✓    | ✓    | ✓    |      |      | ✓    | ✓   |     |     | ✓     |       | ✓     | Knowledge | Yes                                       | Lectures, Tutorials, Assignments, Powerpoint Presentations, Numerical etc. |
| CO 3: Know about constructional details, working and evaluate the performance of centrifugal pump under different vane shape conditions.                              | ✓    | ✓    | ✓    |      |      | ✓    | ✓   |     |     | ✓     |       | ✓     | Knowledge | Yes                                       | Lectures, Tutorials, Assignments, Powerpoint Presentations, Numerical etc. |
| CO 4: Know about constructional details, working and evaluate the performance of reciprocating pump and evaluate the effect of various deviations from the ideal      |      |      |      |      |      |      |     |     |     |       |       |       |           |   |  |
| CO5: Know about constructional details and working of hydraulic devices like fluid coupling, accumulator and intensifier.   |      |      |      |      |      |      |     |     |     |       |       |       | Knowledge | Yes                                       | Lectures, Tutorials, Assignments, Powerpoint Presentations, Numerical etc. |

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|   |   |   |   |   |   |   |   |   |   |   |   |   |                                       |     |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---------------------------------------|-----|--|
| CO1: Illustrate the significance of structure-property-correlation for engineering materials including ferrous and nonferrous.            | √ | √ |   | √ | √ | √ | √ |   | √ | √ | √ | √ | Understanding, Applying and Designing | Yes | Minor Exams, Assignments, End Term Exams |
| CO 2: Explain the use and importance of various heat treatment processes used for engineering materials and their practical applications. | √ |   | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | Understanding, Applying               | Yes | Minor Exams, Assignments, End Term Exams |
| CO 3: Identify the various structural changes occurred in metals with respect to time temperature transformations.                        | √ | √ | √ | √ | √ | √ | √ |   | √ | √ | √ | √ | Understanding, Applying               | Yes | Minor Exams, Assignments, End Term Exams |
| CO 4: Interpret the significance of Fe-C and TTT diagram for controlling the desired structure and properties of the materials.           | √ | √ |   | √ | √ | √ | √ | √ | √ | √ | √ | √ | Understanding, Applying               | Yes | Minor Exams, Assignments, End Term Exams |

**BTME405-18 : Theory of Machines -II**



| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                    | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|-----|------|------|-------|-------|-------|--------------------------|---|--|
| CO1: Understand the basic concepts of inertia forces & couples applied to reciprocating parts of a machine.               | √    | √    | √    | √    |      |      |     |      |      |       | √     | √     | Understanding & Applying | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO2: Understand balancing of rotating and reciprocating parts of machines.  | √    | √    | √    | √    | √    |      |     |      |      |       | √     | √     | Understanding & Applying | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO3: Select suitable type of gears for different application and analyse the motion of different elements of gear trains. | √    | √    | √    | √    | √    |      |     |      |      |       | √     | √     | Understanding & Applying | Yes                                       | Minor Exams, Assignments, End Term Exams     |



|   |   |   |   |   |   |  |  |  |  |  |  |   |                          |                          |                                       |                                       |
|---|---|---|---|---|---|--|--|--|--|--|--|---|--------------------------|--------------------------|---------------------------------------|---------------------------------------|
| CO4: Understand the concept and application of gyroscopic effect. | √ | √ | √ | √ | √ |  |  |  |  |  |  | √ | Understanding & Applying | Yes                      | Minor Exams, Assignments, End T Exams |                                       |
| CO5: Gain knowledge of kinematic synthesis.                       | √ | √ | √ | √ | √ |  |  |  |  |  |  | √ | √                        | Understanding & Applying | Yes                                   | Minor Exams, Buisness Quiz, End Exams |

**EVS101-18 ENVIRONMENTAL SCIENCE**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                    | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|-----|------|------|-------|-------|-------|--------------------------|---|--|
| Students will enable to understand environmental problems at local and national level through literature and general awareness.                                   | √    | √    | √    | √    |      |      |     |      |      |       | √     | √     | Understanding & Applying | Yes                                       | Minor Exams, Assignments, End T Exams        |
| The students will gain practical knowledge by visiting wildlife areas, environmental institutes and various personalities who have done practical work on various | √    | √    | √    | √    | √    |      |     |      |      |       | √     | √     | Understanding & Applying | Yes                                       | Minor Exams, Assignments, End T Exams        |
| The students will apply interdisciplinary approach to understand key environmental issues and critically analyze them to explore the possibilities to mitigate    | √    | √    | √    | √    | √    |      |     |      |      |       | √     | √     | Understanding & Applying | Yes                                       | Minor Exams, Assignments, End T Exams        |
| Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world                            | √    | √    | √    | √    | √    |      |     |      |      |       |       | √     | Understanding & Applying | Yes                                       | Minor Exams, Assignments, End T Exams        |

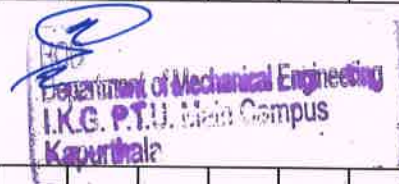
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Kapurthala

**BTME406-18 APPLIED THERMODYNAMICS Lab**



| Course Outcome   | PO 1 (Engineering) | PO 2 (Problem) | PO 3 (Design/De) | PO 4 (Conduct) | PO 5 (Modern) | PO 6 (Therme) | PO 7 (Environment) | PO8 (Ethics) | PO 9 (Individual) | PO 10 (Communication) | PO 11 (Project Man) | PO 12 (Life long) | Skill                                 | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|--------------------|----------------|------------------|----------------|---------------|---------------|--------------------|--------------|-------------------|-----------------------|---------------------|-------------------|---------------------------------------|---|--|
| CO1: Explain the functioning and performance evaluation of reciprocating air compressors.                          | √                  |                | √                | √              | √             | √             | √                  |              | √                 | √                     |                     | √                 | Understanding, Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO 2: Analyze the combustion phenomenon in boilers and I.C. engines.   | √                  | √              |                  | √              | √             | √             | √                  | √            | √                 | √                     | √                   | √                 | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO 3: Use of Steam Tables and Mollier Chart to solve vapour power cycle problems.                                  | √                  | √              | √                | √              | √             | √             | √                  | √            | √                 | √                     | √                   | √                 | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO 4: Demonstrate the constructional features and working of steam power plants and to evaluate their performance. | √                  | √              | √                | √              | √             | √             | √                  |              | √                 | √                     | √                   | √                 | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Term Exams     |

**Paper BTME407-18 Fluid Machines Lab**

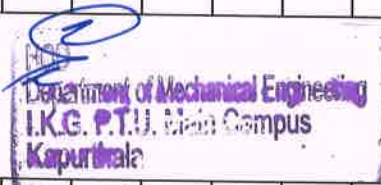


| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|-----|-----|-----|------|------|------|---------------|---|--|
| CO1: Conduct experiments on scaled down models or on actual size hydraulic machines and evaluate results in terms of unit or specific quantities for comparison | √    | √    | √    |      | √    | √    | √   |     | √   | √    | √    | √    | Applying      | Yes                                       | Case Study, Group Discussions etc            |
| CO 2: Understand the working of various hydraulic machines (turbines and pumps) and can suggest remedial solutions for various faults.                          | √    | √    | √    |      | √    | √    | √   |     | √   | √    | √    | √    | Understanding | Yes                                       | Case Study, Group Discussions etc            |

**Paper BTME408-18 Material Engineering Lab**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|---------------|---|--|
| Analyse the microstructure of different ferrous and non-ferrous samples.   | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓   |     | ✓   | ✓     | ✓     | ✓     | Applying      | Yes                                       | Case Study, Group Discussions                |
| Explore the effect of heat treatment on various engineering materials by analysing its microstructure and hardness | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓   |     | ✓   | ✓     | ✓     | ✓     | Understanding | Yes                                       | Case Study, Group Discussions                |

**BMPD401-18 Mentoring and professional Development**



| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO            |
|---|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|---------------|---|---|
| CO1: The student will be able to effectively communicate and present technical material.  | ✓    | ✓    | ✓    |      | ✓    |      | ✓   | ✓   | ✓   | ✓     | ✓     | ✓     | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| CO2: Ability to think critically and creatively to generate innovative and optimum solutions.   |      | ✓    | ✓    |      | ✓    |      | ✓   | ✓   | ✓   | ✓     | ✓     | ✓     | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |
| CO3: The student will be able to identify, evaluate and synthesise information from a range of sources to optimise process engineering design and |      | ✓    | ✓    |      | ✓    |      | ✓   | ✓   | ✓   | ✓     | ✓     | ✓     | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |

|   |  |   |   |  |   |  |   |   |  |   |  |   |  |   |               |     |  |
|---|--|---|---|--|---|--|---|---|--|---|--|---|--|---|---------------|-----|--|
| CO4: Engage in continuous education, training and research, and take control of their own learning and overall development. |  | √ | √ |  | √ |  | √ | √ |  | √ |  | √ |  | √ | Understanding | Yes | Minor Exams, Buisness Quiz, Assignments, End Term Exam |
|---|--|---|---|--|---|--|---|---|--|---|--|---|--|---|---------------|-----|--|

**BTME501-18 Heat Transfer**

| Course Outcome   | PO 1 (Engineering) | PO 2 (Problem) | PO 3 (Design/De) | PO 4 (Conduct) | PO 5 (Modern) | PO 6 (The Engi) | PO 7 (Envirome) | PO8 (Ethics) | PO 9 (Individual) | PO 10 (Communic) | PO 11 (Project Man) | PO 12 (Life long) | Skill                                 | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|--------------------|----------------|------------------|----------------|---------------|-----------------|-----------------|--------------|-------------------|------------------|---------------------|-------------------|---------------------------------------|---|--|
| To teach students the basic principles of conduction, radiation, and convection heat transfer. Students will demonstrate an <u>understanding of the basic</u>                    | √                  |                | √                | √              | √             | √               | √               |              | √                 | √                |                     | √                 | Understanding, Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams          |
| To extend the basic principle of conservation of energy to systems that involve conduction, radiation, and heat transfer. Students will <u>demonstrate an understanding of</u>   | √                  | √              |                  | √              | √             | √               | √               | √            | √                 | √                | √                   | √                 | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Exams          |
| To train students to identify, formulate, and solve engineering problems involving conduction heat transfer. Students will demonstrate <u>the ability to formulate practical</u> | √                  | √              | √                | √              | √             | √               | √               | √            | √                 | √                | √                   | √                 | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Exams          |
| To train students to identify, formulate, and solve engineering problems involving forced convection heat transfer, natural <u>convection heat transfer, and heat</u>            | √                  | √              | √                | √              | √             | √               | √               |              | √                 | √                | √                   | √                 | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Exams          |
| To train students to identify, formulate, and solve engineering problems involving radiation heat transfer among black surfaces and <u>among diffuse gray surfaces.</u>          | √                  | √              | √                | √              | √             | √               | √               |              | √                 | √                | √                   | √                 | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Exams          |

**BTME502-18 : Design of Machine Elements**

Department of Mechanical Engineering  
 K. J. Somaiya Institute of Technology  
 Narurthala

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                                 | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|-----|------|------|-------|-------|-------|---------------------------------------|---|--|
| CO1: Demonstrate recalling and applying knowledge of Basic Sciences, Graphics & Drawing, Basic Manufacturing Processes and <u>Material Science for design</u>           | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |     |      |      | ✓     | ✓     | ✓     | Understanding, Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO2: Comprehend the effect of different stresses and strains under various loading conditions on the mechanical components and <u>identify the mechanism/mode of</u>    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |     |      |      | ✓     | ✓     | ✓     | Understanding and Applying            | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO3: Examine and solve design problems involving machine elements on the basis of various theories of failure.  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |     |      |      | ✓     | ✓     | ✓     | Applying and Designing                | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO4: Synergize forces, moments and strength information to develop ability to analyze, design and/or select machine elements <u>aiming for safety, reliability, and</u> | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   |      |      | ✓     | ✓     | ✓     | Understanding, Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |

**Paper BTME 503-18 Manufacturing Processes**

Department of Mechanical Engineering  
I.K.G. P.T.U. Main Campus  
Kapurthala

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|-----|-----|-----|------|------|------|---------------|---|--|
| CO1: Understand the different conventional manufacturing methods employed for making different products.    | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓   |     |     | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Quiz, Assignments, Term Exams   |
| CO 2: Understand the different unconventional manufacturing methods employed for making different products. | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓   |     |     | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Quiz, Assignments, Term Exams   |



**Paper BTME 503-18 Management & Engineering Economics**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO          |
|--|------|------|------|------|------|------|-----|-----|-----|------|------|------|---------------|---|---|
| CO1: Explain the development of management and the role it plays at different levels in an organization.                                 | ✓    |      |      |      |      |      | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exam |
| CO 2: Comprehend the process and role of effective planning, organizing and staffing for the development of an organization.             |      |      |      |      |      |      | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exam |
| CO 3: Understand the necessity of good leadership, communication and coordination for establishing effective control in an organization. |      |      |      |      |      |      | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exam |
| CO 4: Understand engineering economics demand supply and its importance in economics decision making and problem solving.                |      |      |      |      |      |      | ✓   | ✓   |     | ✓    |      | ✓    | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exam |
| CO 5: Calculate present worth, annual worth and IRR for different alternatives in economic decision making.                              | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Applying      | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exam |
| CO 6: Understand the procedure involved in estimation of cost for a simple component, product costing and depreciation, its methods.     | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   | ✓   | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Buisness Quiz, Assignments,End Term Exam |

**Paper BTME 503-18 Heat Transfer Lab**

Department of Mechanical Engineering  
I.K.G. P.T.U. Main Campus  
Kapurthala



| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|---------------|---|--|
| Design and fabricate the experimental setups related to heat transfer phenomena. | √    | √    | √    |      | √    | √    | √   |     |     | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Quiz, Assignments, Term Exams   |
| Measure and analyse different heat transfer parameters.                          | √    | √    | √    |      | √    | √    | √   |     |     | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Quiz, Assignments, Term Exams   |

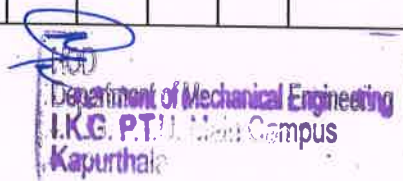
**Paper BTME 506-18 Manufacturing Processes Laboratory**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill    | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|----------|---|--|
| CO1: Determine/calculate the clay content, moisture content, hardness, permeability and grain fineness number of moulding sand sample.                       | √    | √    | √    | √    | √    | √    | √   |     |     | √     | √     | √     | Applying | Yes                                       | Minor Exams, Business Quiz, End Exams        |
| CO 2: Use oxy-acetylene gas welding, manual arc welding, MIG, TIG and spot-welding processes to make various joints.   | √    | √    | √    | √    | √    | √    | √   |     |     | √     | √     | √     | Applying | Yes                                       | Minor Exams, Business Quiz, End Exams        |
| CO 3: Use machine tools such as lathe, shaper and milling machine for machining/cutting various profiles on work pieces.                                     | √    | √    | √    | √    |      |      |     |     |     | √     | √     | √     | Applying | Yes                                       | Minor Exams, Business Quiz, End Exams        |
| CO 4: Learn about the constructional features and working of grinding machines, hydraulic press, draw bench, rolling mills, drawing and extrusion equipment. | √    | √    | √    | √    | √    | √    | √   |     |     | √     | √     | √     | Applying | Yes                                       | Minor Exams, Business Quiz, End Exams        |

**Paper BTME 507-18 Numerical Methods Lab**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill    | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|----------|---|--|
| Understand different implementation modes of numerical methods.  | √    | √    | √    | √    | √    | √    | √   |     |     | √     | √     | √     | Applying | Yes                                       | Minor Exams, Buisness Quiz, End Exams        |
| Use the numerical methods with the understanding of limitations of these methods for solving problems. | √    | √    | √    | √    | √    | √    | √   |     |     | √     | √     | √     | Applying | Yes                                       | Minor Exams, Buisness Quiz, End Exams        |
| Develop and implement their own computer programs.   | √    | √    | √    | √    | √    | √    | √   |     |     | √     | √     | √     | Applying | Yes                                       | Minor Exams, Buisness Quiz, End Exams        |
| Solve problems more accurately and efficiently in low computational time.                              | √    | √    | √    | √    | √    | √    | √   |     |     | √     | √     | √     | Applying | Yes                                       | Minor Exams, Buisness Quiz, End Exams        |
| Handle the problems conveniently which are difficult to deal with manually                             | √    | √    | √    | √    | √    | √    | √   |     |     | √     | √     | √     | Applying | Yes                                       | Minor Exams, Buisness Quiz, End Exams        |

**Paper BTMC102-18 ESSENCE OF INDIAN KNOWLEDGE TRADITION**


  
 Department of Mechanical Engineering  
 I.K.G. P.T.U. Main Campus  
 Kapurthala

| Course Outcome | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|----------------|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|-------|---|--|
|----------------|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|-------|---|--|

|   |   |   |   |   |   |   |   |  |  |   |   |   |          |     |                                       |
|---|---|---|---|---|---|---|---|--|--|---|---|---|----------|-----|---------------------------------------|
| Understand the Philosophy of Indian Knowledge system and its Basic Structure. | √ | √ | √ | √ | √ | √ | √ |  |  | √ | √ | √ | Applying | Yes | Minor Exams, Buisness Quiz, End Exams |
| Understand the Ancient India Culture, Society and Religion.                   | √ | √ | √ | √ | √ | √ | √ |  |  | √ | √ | √ | Applying | Yes | Minor Exams, Buisness Quiz, End Exams |
| Examine the areas of Indian Linguistic Tradition.                             | √ | √ | √ | √ | √ | √ | √ |  |  | √ | √ | √ | Applying | Yes | Minor Exams, Buisness Quiz, End Exams |
| Know the contrubtion of scientists of different eras.                         | √ | √ | √ | √ | √ | √ | √ |  |  | √ | √ | √ | Applying | Yes | Minor Exams, Buisness Quiz, End Exams |
| Handle the problems conveniently which are difficult to deal with manually    | √ | √ | √ | √ | √ | √ | √ |  |  | √ | √ | √ | Applying | Yes | Minor Exams, Buisness Quiz, End Exams |


**Paper BTME 409-18 4 weeks industrial training**

  
 Department of Mechanical Engineering  
 I.K.G. P.T.U. Main Campus  
 Kapurthala

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill    | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|----------|---|--|
| Capability to acquire and apply fundamental principles of engineering. | √    | √    | √    | √    | √    | √    | √   |     |     | √     | √     | √     | Applying | Yes                                       | Minor Exams, Buisness Quiz, End Exams        |
| Become master in one's specialized technology                          | √    | √    | √    | √    | √    | √    | √   |     |     | √     | √     | √     | Applying | Yes                                       | Minor Exams, Buisness Quiz, End Exams        |

|   |   |   |   |   |   |   |   |  |  |   |   |   |          |     |                                       |
|---|---|---|---|---|---|---|---|--|--|---|---|---|----------|-----|---------------------------------------|
| Become updated with all the latest changes in technological world.  | √ | √ | √ | √ | √ | √ | √ |  |  | √ | √ | √ | Applying | Yes | Minor Exams, Buisness Quiz, End Exams |
| Ability to communicate efficiently.   | √ | √ | √ | √ | √ | √ | √ |  |  | √ | √ | √ | Applying | Yes | Minor Exams, Buisness Quiz, End Exams |
| Knack to be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills. | √ | √ | √ | √ | √ | √ | √ |  |  | √ | √ | √ | Applying | Yes | Minor Exams, Buisness Quiz, End Exams |
| Ability to identify, formulate and model problems and find engineering solution based on a systems approach.            | √ | √ | √ | √ | √ | √ | √ |  |  | √ | √ | √ | Applying | Yes | Minor Exams, Buisness Quiz, End Exams |
| Capability and enthusiasm for self-improvement through continuous professional development and life-long learning       | √ | √ | √ | √ | √ | √ | √ |  |  | √ | √ | √ | Applying | Yes | Minor Exams, Buisness Quiz, End Exams |
| Awareness of the social, cultural, global and environmental responsibility as an engineer.                              | √ | √ | √ | √ | √ | √ | √ |  |  | √ | √ | √ | Applying | Yes | Minor Exams, Buisness Quiz, End Exams |

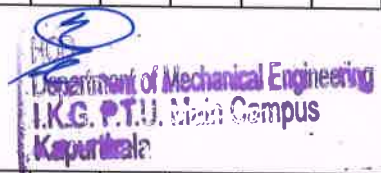
**BTME601-18 REFREGERATION AND AIR CONDITIONING**

  
 Department of Mechanical Engineering  
 I.K.G. P.T.U. Main Campus  
 Kapurthala

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|------|------|------|------|------|------|-----|------|------|-------|-------|-------|---------------|---|--|
| CO1: Understand the fundamental principles and applications of refrigeration and air conditioning system | √    | √    | √    | √    | √    |      |     | √    | √    | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Assignments, End Exams          |

|   |   |   |   |   |   |   |   |   |   |   |   |   |                        |     |                                     |
|---|---|---|---|---|---|---|---|---|---|---|---|---|------------------------|-----|-------------------------------------|
| CO2: The students will be able to obtain cooling capacity and coefficient of performance by conducting test on refrigeration systems        | ✓ | ✓ | ✓ | ✓ | ✓ |   | ✓ |   | ✓ |   | ✓ | ✓ | Applying and Designing | Yes | Minor Exams, Assignments, End Exams |
| CO3: The students will develop ability to calculate the energy requirements of cooling and heat equipment for air conditioning applications | ✓ |   | ✓ | ✓ | ✓ | ✓ | ✓ |   | ✓ | ✓ | ✓ | ✓ | Applying and Designing | Yes | Minor Exams, Assignments, End Exams |
| CO4: The students will be able to Explain the properties, applications and environmental issues of different refrigerants.                  | ✓ | ✓ |   | ✓ | ✓ | ✓ |   | ✓ | ✓ | ✓ |   | ✓ | Applying and Designing | Yes | Minor Exams, Assignments, End Exams |
| CO5: The students can demonstrate an ability to analysis psychrometric processes and cycles of air conditioning systems.                    | ✓ | ✓ | ✓ | ✓ | ✓ |   | ✓ |   | ✓ | ✓ | ✓ | ✓ | Applying and Designing | Yes | Minor Exams, Assignments, End Exams |

**Paper BTME602-18 Mechanical Measurements & Metrology**



| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO                         |
|--|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|---------------|---|--|
| CO1: To provide a knowledge about measurement systems and their components                         | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |     |     | ✓   | ✓     | ✓     | ✓     | Knowledge     | Yes                                       | Lectures, Tutorials, Assignment Powerpoint Presentations, Numer etc. |
| CO 2: To learn about various sensors and transducers used for measurement of mechanical quantities | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |     |     | ✓   | ✓     | ✓     | ✓     | Understanding | Yes                                       | Lectures, Tutorials, Assignment Powerpoint Presentations, Numer etc. |
| CO 3: To learn about usage of various measuring instruments.                                       | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |     |     | ✓   | ✓     | ✓     | ✓     | Understanding | Yes                                       | Lectures, Tutorials, Assignment Powerpoint Presentations, Numer etc. |

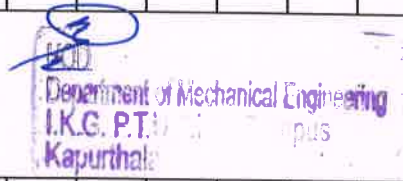


|  |   |   |   |   |   |   |  |  |  |   |   |   |   |               |     |  |
|--|---|---|---|---|---|---|--|--|--|---|---|---|---|---------------|-----|--|
| CO 4: To learn metrology of screw, gear and surface texture. | √ | √ | √ | √ | √ | √ |  |  |  | √ | √ | √ | √ | Understanding | Yes | Lectures, Tutorials, Assignment<br>Powerpoint Presentations, Numerical<br>etc. |
|--|---|---|---|---|---|---|--|--|--|---|---|---|---|---------------|-----|--|

**BTME603-18 AUTOMOBILE ENGINEERING**

| Course Outcome   | PO 1<br>(Engineering) | PO 2<br>(Problem) | PO 3<br>(Design/De) | PO 4<br>(Conduct) | PO 5<br>(Modern) | PO 6<br>(The Engi) | PO 7<br>(Environment) | PO8<br>(Ethics) | PO 9<br>(Individual) | PO 10<br>(Communication) | PO 11<br>(Project Man) | PO 12<br>(Life long) | Skill                                 | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|-----------------------|-------------------|---------------------|-------------------|------------------|--------------------|-----------------------|-----------------|----------------------|--------------------------|------------------------|----------------------|---------------------------------------|---|--|
| CO1: Identify the different parts of the automobile.   | √                     |                   | √                   | √                 | √                | √                  | √                     |                 | √                    | √                        | √                      | √                    | Understanding, Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO 2: Demonstrate the working of various parts like engine, transmission, clutch, brakes, steering and the suspension systems. | √                     |                   | √                   | √                 | √                | √                  | √                     | √               | √                    | √                        | √                      | √                    | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO 3: Explain the need of vehicle safety systems and future developments in the automobile industry.                           | √                     | √                 | √                   | √                 | √                | √                  | √                     | √               | √                    | √                        | √                      | √                    | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Term Exams     |

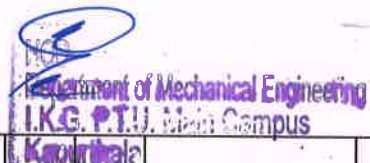
**Paper BTME 604-18 Introduction to Industrial Management**



| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO            |
|---|------|------|------|------|------|------|-----|-----|-----|------|------|------|---------------|---|---|
| CO1: 1.Understand the complexities associated with management in the organizations and integrate the learning in handling these complexities. | √    | √    | √    |      | √    | √    | √   | √   | √   | √    | √    | √    | Understanding | Yes                                       | Minor Exams, Business Quiz, Assignments, End Term Exams |

|  |   |   |   |   |   |   |   |   |   |   |   |   |          |     |   |
|--|---|---|---|---|---|---|---|---|---|---|---|---|----------|-----|---|
| CO 2: 2.Demonstrate the roles, skills and functions of management. | √ | √ | √ |   | √ | √ | √ | √ | √ | √ | √ | √ | Applying | Yes | Minor Exams, Buisness Quiz, Assignments,End Term Exam |
| CO 3: 3.Understand the concepts related to industrial management.  | √ | √ | √ | √ |   | √ | √ | √ | √ | √ | √ | √ | Applying | Yes | Minor Exams, Buisness Quiz, Assignments,End Term Exam |

**BTME605-18 REFREGERATION AND AIR CONDITIONING LAB**



| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|------|------|------|------|------|------|-----|------|------|-------|-------|-------|------------------------|---|--|
| CO1: Understand the fundamental principles and applications of refrigeration and air conditioning system                                     | √    | √    | √    | √    | √    |      | √   | √    | √    | √     | √     | √     | Understanding          | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO2: The students will be able to obtain cooling capacity and coefficient of performance by conducting test on refrigeration systems         | √    | √    | √    | √    | √    |      | √   |      | √    |       | √     | √     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO3: The students will develop ability to calculate the energy requirements of cooling and heat equipment for air conditioning applications. | √    |      | √    | √    | √    | √    | √   |      | √    | √     | √     | √     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO4: The students will be able to Explain the properties, applications and environmental issues of different refrigerants.                   | √    | √    |      | √    | √    | √    |     | √    | √    | √     |       | √     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO5: The students can demonstrate an ability to analysis psychrometric processes and cycles of air conditioning systems.                     | √    | √    | √    | √    | √    |      | √   |      | √    | √     | √     | √     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |

**Paper BTME606-18 Mechanical Measurements & Metrology Lab**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|-----|-----|-----|------|------|------|---------------|---|--|
| CO1: Demonstrate the use of instruments for measuring linear (internal and external), angular dimensions and surface roughness. | √    | √    | √    | √    | √    | √    |     |     | √   | √    | √    | √    | Understanding | Yes                                       | Case Study, Group Discussions,               |
| CO 2: Identify proper measuring instrument and know requirement of calibration, errors in measurement etc.                      | √    | √    | √    | √    | √    | √    |     |     | √   | √    | √    | √    | Knowledge     | Yes                                       | Case Study, Group Discussions,               |
| CO 3: Apply analytical and experimental methods to make measurements and to find and correct defects in measurement systems.    | √    | √    | √    | √    | √    | √    |     |     | √   | √    | √    | √    | Applying      | Yes                                       | Case Study, Group Discussions,               |

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**BTME603-18 AUTOMOBILE ENGINEERING LAB**

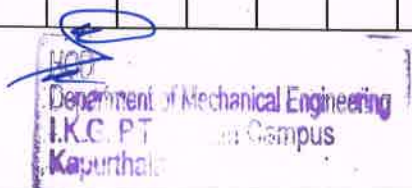
| Course Outcome   | PO 1 (Engineering) | PO 2 (Problem) | PO 3 (Design/Design) | PO 4 (Conduct) | PO 5 (Modern) | PO 6 (Thermal Engineering) | PO 7 (Environment) | PO8 (Ethics) | PO 9 (Individual) | PO 10 (Communication) | PO 11 (Project Management) | PO 12 (Life Long) | Skill                                 | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|--------------------|----------------|----------------------|----------------|---------------|----------------------------|--------------------|--------------|-------------------|-----------------------|----------------------------|-------------------|---------------------------------------|---|--|
| CO1: Identify the different parts of the automobile.   | √                  |                | √                    | √              | √             | √                          | √                  |              | √                 | √                     | √                          | √                 | Understanding, Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO 2: Demonstrate the working of various parts like engine, transmission, clutch, brakes, steering and the suspension systems. | √                  |                | √                    | √              | √             | √                          | √                  | √            | √                 | √                     | √                          | √                 | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Term Exams     |

|  |   |   |   |   |   |   |   |   |   |   |   |   |   |                         |     |                                     |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|-------------------------|-----|-------------------------------------|
| CO 3: Explain the need of vehicle safety systems and future developments in the automobile industry. | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | Understanding, Applying | Yes | Minor Exams, Assignments, End Exams |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|-------------------------|-----|-------------------------------------|

**BTME-608-18 : Minor Project**

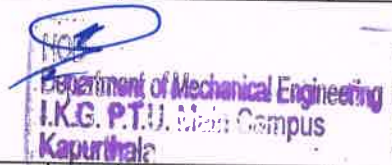
| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|-----|------|------|-------|-------|-------|------------------------|---|--|
| CO1: Identify an open ended problem in area of mechanical engineering which requires further investigation. | √    |      | √    |      | √    | √    | √   | √    | √    | √     | √     | √     | Understanding          | Yes                                       | Reports, Project Presentations and Viva      |
| CO2: Identify the methods and materials required for the project work.                                      | √    | √    | √    | √    | √    | √    | √   | √    | √    | √     | √     | √     | Applying and Designing | Yes                                       | Reports, Project Presentations and Viva      |
| CO3: Manage the work with team members.   | √    |      | √    | √    | √    | √    | √   | √    | √    | √     | √     | √     | Applying and Designing | Yes                                       | Reports, Project Presentations and Viva      |
| CO4: . Formulate and implement innovative ideas for social and environmental benefits.                      | √    | √    | √    | √    | √    | √    | √   | √    | √    | √     | √     | √     | Applying and Designing | Yes                                       | Reports, Project Presentations and Viva      |
| CO5: Write technical report of the project apart from developing a presentation.                            | √    | √    | √    | √    | √    | √    | √   |      | √    | √     | √     | √     | Applying and Designing | Yes                                       | Reports, Project Presentations and Viva      |

**Paper: Internal Combustion Engines 609-18**



| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO                         |
|--|------|------|------|------|------|-----|-----|-----|-----|------|------|------|---------------|---|--|
| CO1: Knowledge about the basics of IC engines  | ✓    | ✓    | ✓    | ✓    |      |     | ✓   |     | ✓   | ✓    |      | ✓    | Understanding | Yes                                       | Minor Exams, Quiz, demonstration through videos/ lab, End Term Exams |
| CO2: Ability to evaluate operational characteristics of IC Engines                       | ✓    | ✓    | ✓    | ✓    |      | ✓   | ✓   |     | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Quiz, demonstration through videos/ lab, End Term Exams |
| CO3: Ability to ascertain the effects of fuel/supply systems on emission from an engine. |      | ✓    | ✓    | ✓    | ✓    |     | ✓   |     |     |      | ✓    | ✓    | Understanding | Yes                                       | Minor Exams, Quiz, demonstration through videos/ lab, End Term Exams |
| CO4: Ability to test engine performance  |      | ✓    | ✓    | ✓    | ✓    |     | ✓   | ✓   |     | ✓    |      | ✓    | Applying      |   |  |

**BTME-610-18 Mechatronics Systems**



| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|-----|------|------|-------|-------|-------|------------------------|---|--|
| CO1: Design mux, demux, flip-flops, and shift registers.  |      | ✓    | ✓    | ✓    | ✓    |      | ✓   | ✓    | ✓    | ✓     | ✓     |       | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO2: Describe the block diagram, registers, ALU, bus systems, timing & control signals, instruction cycles, and interrupts of 8085 microprocessors. | ✓    | ✓    |      |      | ✓    |      | ✓   | ✓    | ✓    | ✓     | ✓     | ✓     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |



|   |   |   |   |   |   |   |   |   |   |   |   |   |                        |     |                                     |
|---|---|---|---|---|---|---|---|---|---|---|---|---|------------------------|-----|-------------------------------------|
| CO3: Apply the concept of 8085 microprocessor instruction sets and addressing modes in writing assembly language program for a given problem. | ✓ | ✓ | ✓ |   | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   | Applying and Designing | Yes | Minor Exams, Assignments, End Exams |
| CO4: Describe the interfacing of memory, 8255 PPI, ADC, DAC, 7-segment LED system, stepper motor, 8251 and 8253 ICs with 8085 microprocessor  | ✓ |   | ✓ | ✓ | ✓ |   | ✓ |   |   |   | ✓ | ✓ | Applying and Designing | Yes | Minor Exams, Assignments, End Exams |

**BTME-611-18 Microprocessor in automation**

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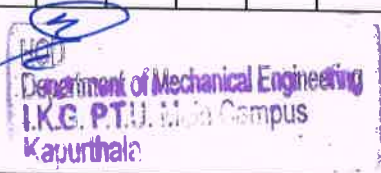
| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|------|------|------|------|------|------|-----|------|------|-------|-------|-------|------------------------|---|--|
| Student is able to describe the architecture and different modes of operations of a typical microprocessor.  |      | ✓    | ✓    | ✓    | ✓    |      | ✓   | ✓    | ✓    | ✓     | ✓     |       | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams          |
| Student is able to understand different addressing modes and instructions of 8086 design and develop assembly language programs using software interrupts. | ✓    | ✓    |      |      | ✓    |      | ✓   | ✓    | ✓    | ✓     | ✓     | ✓     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams          |
| Student is able to interface memory, I/O devices and interrupt controller with 8086 microprocessors.   | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓   | ✓    | ✓    | ✓     | ✓     |       | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams          |
| Student is able to describe the internal architecture and different modes of operations of a typical microcontroller                                       | ✓    |      | ✓    | ✓    | ✓    |      | ✓   |      |      | ✓     |       | ✓     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams          |
| Student is able to design and develop assembly language programs using 8051 microcontroller  | ✓    |      | ✓    | ✓    | ✓    |      | ✓   |      |      | ✓     |       | ✓     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams          |

|   |   |  |   |   |   |  |   |  |  |   |  |   |  |                        |     |                                     |
|---|---|--|---|---|---|--|---|--|--|---|--|---|--|------------------------|-----|-------------------------------------|
| CS 305.6 Student is able to analyze and compare the features of microprocessors and microcontrollers. | √ |  | √ | √ | √ |  | √ |  |  | √ |  | √ |  | Applying and Designing | Yes | Minor Exams, Assignments, End Exams |
|---|---|--|---|---|---|--|---|--|--|---|--|---|--|------------------------|-----|-------------------------------------|

**BTME612-18 COMPOSITE MATERIALS**

| Course Outcome   | PO 1 (Engineering) | PO 2 (Problem) | PO 3 (Design/De) | PO 4 (Conduct) | PO 5 (Modern) | PO 6 (Therme) | PO 7 (Environme) | PO8 (Ethics) | PO 9 (Individual) | PO 10 (Communic) | PO 11 (Project Man) | PO 12 (Life long) | Skill                                 | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|--------------------|----------------|------------------|----------------|---------------|---------------|------------------|--------------|-------------------|------------------|---------------------|-------------------|---------------------------------------|---|--|
| CO1: Explain the concept, need and applications of composite materials.                                | √                  | √              | √                | √              | √             | √             | √                |              | √                 | √                |                     | √                 | Understanding, Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams          |
| CO 2: Suggest/select optimum combination of Matrix/Reinforcement for various engineering applications. | √                  | √              | √                | √              | √             | √             | √                | √            | √                 | √                | √                   | √                 | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Exams          |
| CO 3: Analyze the effects of influencing factors on the strength of composite materials.               | √                  | √              | √                | √              | √             | √             | √                |              | √                 |                  | √                   | √                 | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Exams          |

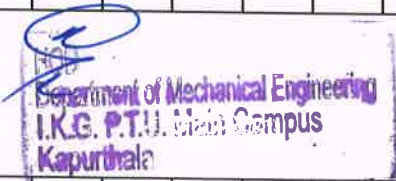
**BTME-613-18 Computer Aided Design**



| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|-----|------|------|-------|-------|-------|------------------------|---|--|
| CO1: Create the different wireframe primitives using parametric representations | √    | √    | √    |      | √    |      | √   | √    |      | √     | √     |       | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams          |

|  |   |   |   |   |   |   |   |   |   |   |   |   |                        |     |                                     |
|--|---|---|---|---|---|---|---|---|---|---|---|---|------------------------|-----|-------------------------------------|
| CO2: Create surface primitives using parametric modeling.                                |   | √ |   | √ | √ |   | √ | √ | √ |   | √ | √ | Applying and Designing | Yes | Minor Exams, Assignments, End Exams |
| CO3: Create the different solid primitives using the different representation schemes    | √ |   | √ | √ | √ |   | √ | √ | √ | √ | √ |   | Applying and Designing | Yes | Minor Exams, Assignments, End Exams |
| CO4: Apply geometric transformations on the created wireframe, surface and solid models. | √ | √ | √ |   | √ | √ | √ |   | √ | √ |   | √ | Applying and Designing | Yes | Minor Exams, Assignments, End Exams |

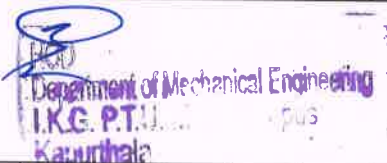
**Paper BTME 614-18 Product Design & Development**



| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO1 2 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|-----|-----|-----|-------|-------|-------|---------------|---|--|
| CO1: Understand desirable design aspects considering various production processes and also understand the economic factors of design.                 | √    | √    | √    | √    | √    | √    | √   | √   | √   | √     | √     | √     | Understanding | Yes                                       | Minor Exams, Quiz, Assignments, Term Exams   |
| CO 2: Employ engineering, scientific, and mathematical principles to execute a design from concept to finished product.                               | √    | √    | √    | √    | √    | √    | √   | √   | √   | √     | √     | √     | Applying      | Yes                                       | Minor Exams, Quiz, Assignments, Term Exams   |
| CO 3: Apply the modern approaches to product design considering concurrent design, quality function deployment and various rapid prototyping methods. | √    | √    | √    | √    | √    | √    | √   | √   | √   | √     | √     | √     | Applying      | Yes                                       | Minor Exams, Quiz, Assignments, Term Exams   |
| CO 4: Apply innovative process techniques in synthesizing information, problem-solving and critical thinking.   | √    | √    | √    | √    | √    | √    | √   | √   | √   | √     | √     | √     | Applying      | Yes                                       | Minor Exams, Quiz, Assignments, Term Exams   |

**BTME 615-18 : Non Conventional Energy Resources**

| Course Outcome   | PO 1 | PO 2 | PO3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|------|------|-----|------|------|------|-----|------|------|-------|-------|-------|---------------|---|--|
| CO1: To Explain renewable energy sources & systems.  | √    | √    |     |      |      | √    |     |      |      |       |       | √     | Understanding | Yes                                       | Minor Exams, Business Quiz, End Exams        |
| CO2: To Apply engineering techniques to build solar, wind, tidal, geothermal, biofuel, fuel cell, Hydrogen and sterling engine                           | √    | √    | √   | √    | √    | √    | √   | √    | √    |       | √     |       | Designing     | Yes                                       | Minor Exams, Business Quiz, End Exams        |
| CO3: To Analyze and evaluate the implication of renewable energy. Concepts in solving numerical problems pertaining to solar radiation geometry and wind | √    | √    | √   | √    | √    | √    | √   |      |      |       | √     |       | Applying      | Yes                                       | Minor Exams, Business Quiz, End Exams        |
| CO4: To Demonstrate self-learning capability to design & establish renewable energy systems.   | √    | √    | √   | √    | √    | √    | √   | √    | √    |       | √     | √     | Applying      | Yes                                       | Minor Exams, Business Quiz, End Exams        |
| CO5: To Conduct experiments to assess the performance of solar PV, solar thermal and biodiesel systems   | √    | √    | √   | √    | √    | √    | √   | √    | √    |       | √     | √     | Applying      | Yes                                       | Minor Exams, Business Quiz, End Exams        |

**BTME616-18 : OPERATION RESEARCH**


| Course Outcome | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|----------------|------|------|------|------|------|------|-----|------|------|-------|-------|-------|-------|---|--|
|----------------|------|------|------|------|------|------|-----|------|------|-------|-------|-------|-------|---|--|



|  |   |   |   |   |   |  |  |  |   |   |   |   |   |                         |     |  |
|--|---|---|---|---|---|--|--|--|---|---|---|---|---|-------------------------|-----|--|
| CO1: Explain various mathematical deterministic operation research models. | √ | √ | √ | √ | √ |  |  |  | √ | √ | √ | √ | √ | Understanding, Applying | Yes | Minor Exams, Class and Home Assignments, End Term Exam |
| CO2: Describe the problems of probabilistic and simulation models.         | √ | √ | √ | √ | √ |  |  |  | √ | √ | √ | √ | √ | Understanding, Applying | Yes | Minor Exams, Class and Home Assignments, End Term Exam |
| CO3: Demonstrate the queuing, inventory and replacement models etc.        | √ | √ | √ | √ | √ |  |  |  | √ | √ | √ | √ | √ | Applying and Designing  | Yes | Minor Exams, Class and Home Assignments, End Term Exam |
| CO4: Formulate and analyze the network models.                             | √ | √ | √ | √ | √ |  |  |  | √ | √ | √ | √ | √ | Applying and Designing  | Yes | Minor Exams, Class and Home Assignments, End Term Exam |

**BTME617-18: MAINTENANCE & RELIABILITY**




| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|------|------|------|------|------|------|-----|------|------|-------|-------|-------|------------------------|---|--|
| CO1: Understand the concepts of reliability and maintainability  | √    | √    | √    | √    | √    | √    | √   | √    | √    | √     | √     | √     | Understanding          | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO2: The students will be able to use statistical tools to characterise the reliability of an item and determine the reliability of a system, and will also understand | √    | √    | √    | √    | √    | √    | √   | √    | √    | √     | √     | √     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO3: The students will develop ability in formulating suitable maintenance strategies to enhance system reliability of a manufacturing system                          | √    | √    | √    | √    | √    | √    | √   | √    | √    | √     | √     | √     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |



**Paper BTME701-18 Mechanical Vibrations**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO                               |
|--|------|------|------|------|------|------|-----|-----|-----|------|------|------|---------------|---|--|
| CO1: Formulate mathematical models of problems in vibrations using Newton's second law or energy | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   |     | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Lectures, Tutorials, Assignments, Powerpoint Presentations, Numerical etc. |
| CO 2: Understand the need and measurement of vibration in mechanical systems.                    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   |     | ✓   | ✓    | ✓    | ✓    | Understanding | Yes                                       | Lectures, Tutorials, Assignments, Powerpoint Presentations, Numerical etc. |
| CO 3: Calculate principal modes of vibration.  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   |     | ✓   | ✓    | ✓    | ✓    | Applying      | Yes                                       | Lectures, Tutorials, Assignments, Powerpoint Presentations, Numerical etc. |
| CO4: Explore the suitable methods of vibration reduction and absorption.                         | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   |     | ✓   | ✓    | ✓    | ✓    | Applying      | Yes                                       | Lectures, Tutorials, Assignments, Powerpoint Presentations, Numerical etc. |
| CO5: Ability to determine vibratory responses of SDOF and MDOF systems.                          | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   |     | ✓   | ✓    | ✓    | ✓    | Analyse       | Yes                                       | Lectures, Tutorials, Assignments, Powerpoint Presentations, Numerical etc. |
| CO6: Ability to determine vibratory responses of SDOF and MDOF systems.                          | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   |     | ✓   | ✓    | ✓    | ✓    | Analyse       | Yes                                       | Lectures, Tutorials, Assignments, Powerpoint Presentations, Numerical etc. |

**Paper BTME702-18 Automation in manufacturing**

  
 Department of Mechanical Engineering  
 G. R. T. U. Main Campus  
 apurthala

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO                         |
|--|------|------|------|------|------|------|-----|-----|-----|------|------|------|---------------|---|--|
| Illustrate the basic concepts of automation in machine tools.                              |      |      |      |      |      |      |     |     |     |      |      |      |               |   |  |
| Analyze various automated flow lines, Explain assembly systems and line balancing methods. | √    | √    | √    | √    | √    | √    | √   |     | √   | √    | √    | √    | Applying      | Yes                                       | Lectures, Tutorials, Assignment Powerpoint Presentations, Numer etc. |
| Describe the importance of automated material handling and storage systems.                | √    | √    | √    | √    | √    | √    | √   |     | √   | √    | √    | √    | Understanding | Yes                                       | Lectures, Tutorials, Assignment Powerpoint Presentations, Numer etc. |
| Interpret the importance of adaptive control systems, automated inspection systems.        | √    | √    | √    | √    | √    | √    | √   |     | √   | √    | √    | √    | Applying      | Yes                                       | Lectures, Tutorials, Assignment Powerpoint Presentations, Numer etc. |

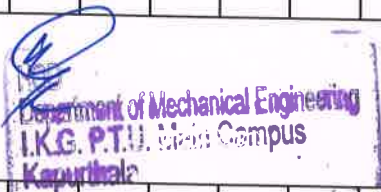
**BTME703-18 Fundamentals of Management for Engineers**

Department of Mechanical Engineering  
I.K.G. P.T.U. Main Campus  
Kapurthala

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                   | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|-----|------|------|-------|-------|-------|-------------------------|---|--|
| CO1: The students understand the significance of Management in their Profession                                       | √    |      |      |      |      | √    |     | √    | √    | √     | √     | √     | Understanding           | Yes                                       | Minor Exams, Assignments, End T Exams        |
| CO2: The various Management Functions like Planning, Organizing, Staffing, Leading, aspects are learnt in this course | √    |      |      | √    | √    | √    |     | √    | √    | √     | √     | √     | Understanding, Applying | Yes                                       | Minor Exams, Assignments, End T Exams        |

|   |   |   |   |   |   |   |  |   |   |   |   |   |                         |     |                                     |
|---|---|---|---|---|---|---|--|---|---|---|---|---|-------------------------|-----|-------------------------------------|
| CO3: Understand the complexities associated with management in the organizations and integrate the learning in handling these complexities. | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  | ✓ | ✓ | ✓ | ✓ | ✓ | Understanding, Applying | Yes | Minor Exams, Assignments, End Exams |
| CO4: Demonstrate the roles, skills and functions of management.   | ✓ |   |   | ✓ | ✓ | ✓ |  | ✓ | ✓ | ✓ | ✓ | ✓ | Applying                | Yes | Minor Exams, Assignments, End Exams |

**BTME-704-18 : Project-II**



| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|------|------|------|------|------|------|-----|------|------|-------|-------|-------|------------------------|---|--|
| CO1: To create an Industrial environment and culture within the institution.   | ✓    |      | ✓    |      | ✓    | ✓    | ✓   | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding          | Yes                                       | Reports, Project Presentations and Viva      |
| CO2: To set up production lab utilizing the infrastructure of the institution.   | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓   | ✓    | ✓    | ✓     | ✓     | ✓     | Applying and Designing | Yes                                       | Reports, Project Presentations and Viva      |
| CO3: To standardize laboratories to industrial standard, thereby giving exposure to industrial housekeeping standards. | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓   | ✓    | ✓    | ✓     | ✓     | ✓     | Applying and Designing | Yes                                       | Reports, Project Presentations and Viva      |
| CO4: Demonstrate an ability to present and defend their research work to a panel of experts.                           | ✓    |      | ✓    | ✓    | ✓    | ✓    | ✓   | ✓    | ✓    | ✓     | ✓     | ✓     | Applying and Designing | Yes                                       | Reports, Project Presentations and Viva      |
| CO5: Demonstrate knowledge of contemporary issues in their chosen field of research.                                   | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓   |      | ✓    | ✓     | ✓     | ✓     | Applying and Designing | Yes                                       | Reports, Project Presentations and Viva      |

**BTME-801 Software/Industrial Training**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|-----|------|------|-------|-------|-------|------------------------|---|--|
| Capability to acquire and apply fundamental principles of engineering.  | √    |      | √    |      | √    | √    | √   | √    | √    | √     | √     | √     | Understanding          | Yes                                       | Reports, Project Presentations and Viva      |
| Become master in one's specialized technology   | √    | √    | √    |      | √    | √    | √   | √    | √    | √     | √     | √     | Applying and Designing | Yes                                       | Reports, Project Presentations and Viva      |
| Become updated with all the latest changes in technological world.  | √    | √    | √    |      | √    | √    | √   | √    | √    | √     | √     | √     | Applying and Designing | Yes                                       | Reports, Project Presentations and Viva      |
| Ability to communicate efficiently.   | √    |      | √    | √    | √    | √    | √   | √    | √    | √     | √     | √     | Applying and Designing | Yes                                       | Reports, Project Presentations and Viva      |
| Knack to be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills. | √    | √    | √    | √    | √    | √    | √   |      | √    | √     | √     | √     | Applying and Designing | Yes                                       | Reports, Project Presentations and Viva      |
| Ability to identify, formulate and model problems and find engineering solution based on a systems approach.            | √    | √    | √    |      | √    | √    | √   |      | √    | √     | √     | √     | Applying and Designing | Yes                                       | Reports, Project Presentations and Viva      |
| Capability and enthusiasm for self-improvement through continuous professional development and life-long learning       | √    | √    | √    | √    | √    | √    | √   |      | √    | √     | √     | √     | Applying and Designing | Yes                                       | Reports, Project Presentations and Viva      |

|   |   |   |   |   |   |   |   |  |   |   |   |   |                        |     |   |
|---|---|---|---|---|---|---|---|--|---|---|---|---|------------------------|-----|---|
| Awareness of the social, cultural, global and environmental responsibility as an engineer | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  | ✓ | ✓ | ✓ | ✓ | Applying and Designing | Yes | Reports, Project Presentations and Viva |
|---|---|---|---|---|---|---|---|--|---|---|---|---|------------------------|-----|---|

  
 Department of Mechanical Engineering  
 I.K.G. P.T.U. Main Campus  
 Kapurthala



**Name of Department: Mechanical Department**

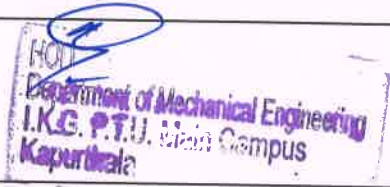
**Paper: Advanced Engineering Materials MTME-101-18**

**Course Outcome**

|   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurs hip | Assessment Tool Measure Attainment of CO                |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------|--|---|
| CO1: Identify and describe different types of material processing techniques for advanced materials | √    | √    | √    | √    |      | √    | √    |      | √    | √     | √     |       | Understanding | Yes  | Minor Exams, Q demonstrations th videos/ lab, End Exams |
| CO2: Ability to select suitable material for specific applications                                  | √    | √    | √    | √    |      | √    | √    | √    | √    | √     |       | √     | Understanding | Yes  | Minor Exams, Q demonstrations th videos/ lab, End Exams |

**Finite Element Method**

**Course Outcome**



|  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurs hip | Assessment Tool Measure Attainment of CO |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------|--|--|
| CO1: Explain the principles of vibrations;   | √    |      |      | √    |      | √    | √    |      |      | √     | √     | √     | Understanding | Yes  | Minor Exams, Buis Quiz, End Term Ex      |
| CO2: Define and describe the concepts of vibration modes and natural frequencies and their measurement and estimation for multi-degree-of-freedom systems; | √    | √    |      | √    |      | √    |      |      |      |       |       | √     | Understanding | Yes  | Minor Exams, Buis Quiz, End Term Ex      |
| CO3: Explain System Modelling via use of Energy Analysis and its application to complex vibrating systems;   | √    | √    | √    | √    | √    | √    | √    |      |      |       | √     |       | Applying      | Yes  | Minor Exams, Buis Quiz, End Term Ex      |
| CO4: solve linear 2D structural beams and frames problems; 1D heat conduction and convection heat transfer problems.                                       | √    | √    |      | √    |      | √    |      |      |      |       |       |       | Applying      | Yes  | Minor Exams, Buis Quiz, End Term Ex      |
| CO5: Recognise the use of different numerical techniques and its application to vibration design;  | √    | √    | √    | √    | √    | √    |      |      | √    |       | √     | √     | Designing     | Yes  | Minor Exams, Buis Quiz, End Term Ex      |

**MTME-103 :Advanced Design of Mechanical Systems**

**Course Outcome**

|   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurs hip | Assessment Tool Measure Attainment of CO |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------|--|--|
| CO1: Learn integrating CAE, CAD, CAM tools. | √    | √    | √    | √    | √    | √    |      |      |      | √     | √     | √     | Understanding | Yes  | Minor Exams, Assignments, End Exams      |

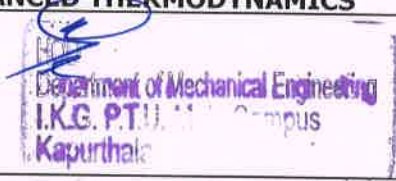
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|---|---|---|---|---|---|---|--|--|--|--|---|---|---|-----------------------------|-----|-------------------------------------|
| CO2: Learn about proper material selection and know about influence of materials on form design of welded members, forgings and castings. | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  |  |  |  | ✓ | ✓ | ✓ | Understanding and Designing | Yes | Minor Exams, Assignments, End Exams |
| CO3: Understand general design principles for manufacturability.  | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  |  |  |  | ✓ | ✓ | ✓ | Understanding and Designing | Yes | Minor Exams, Assignments, End Exams |
| CO4: Design to minimize material usage, design for recyclability & energy efficiency and design to regulations and standards.             | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  |  |  |  | ✓ | ✓ | ✓ | Understanding and Designing | Yes | Minor Exams, Assignments, End Exams |

**MTME-104 : Operations Management**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                      | Focus on Employability / Entrepreneurship | Assessment Tool Measure Attainment of CO |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|----------------------------|---|--|
| CO1: Understand the concepts of operations management and various types of manufacturing systems & plant layouts with their characteristics, merits and demerits. | ✓    | ✓    | ✓    | ✓    | ✓    |      |      | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding and Applying | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO2: Learn about different types of planning and concepts of MACRO & MICRO process design.  | ✓    | ✓    | ✓    | ✓    | ✓    |      |      | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding and Applying | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO3: Know about the concepts of demand forecasting, various demand patterns and qualitative and quantitative techniques of demand forecasting.                    | ✓    | ✓    | ✓    | ✓    | ✓    |      |      | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding and Applying | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO4: Understand the concept of aggregate production planning, different scheduling criteria and multi-stage manufacturing systems.                                | ✓    | ✓    | ✓    | ✓    | ✓    |      |      | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding and Applying | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO5: Learn about various types of material flow and concepts of MRP, MRP-II, JIT and ERP along with their characteristics.  | ✓    | ✓    | ✓    | ✓    | ✓    |      |      | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding and Applying | Yes                                       | Minor Exams, Assignments, End Exams      |

**MTME-105 ADVANCED THERMODYNAMICS**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                                 | Focus on Employability / Entrepreneurship | Assessment Tool Measure Attainment of CO |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------------------------------|---|--|
| CO1: Describe the various laws of thermodynamics and their applications.   | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding, Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO 2: Explain the concepts of availability and irreversibility with respect to reacting and nonreacting systems. | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO 3: Describe methods in using equations of potentials, availability, and exergy for thermodynamic analysis.    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |       | ✓     | ✓     | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Exams      |



CO 4: Analyse the direct energy conversion methods and their applications.

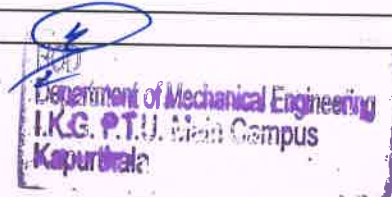
|   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

Understanding, Applying  
Yes  
Minor Exams, Assignments, End Exams

**MTME 201 RESEARCH METHODOLOGY**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                                 | Focus on Employability / Entrepreneurship | Assessment Tool Measure Attainment of CO |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------------------------------|---|--|
| CO1: Formulate a research problem                                    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |       | ✓     | ✓     | Understanding, Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO 2: Explain the different experimental designs and their analysis. | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO 3: Apply different statistical tools for the research analysis    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO 4: Apply the research ethics                                      | ✓    |      | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Exams      |

**MTME-202 Tribology**



| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tool Measure Attainment of CO |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|------------------------|---|--|
| CO1: The student will be able to study research papers for understanding of a new field and summarise them. | ✓    | ✓    | ✓    |      | ✓    |      | ✓    | ✓    | ✓    | ✓     |       | ✓     | Understand             | Yes                                       | Final Viva                               |
| CO2: Ability to identify promising new directions of various cutting edge technologies.                     |      | ✓    | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓    |       | ✓     | ✓     | Applying and Designing | Yes                                       | Final Viva                               |
| CO3: The student will be able to effectively communicate by making an oral presentation.                    | ✓    |      | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓     | ✓     |       | Applying and Designing | Yes                                       | Final Viva                               |

**MTME-203: Modern Manufacturing Processes**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tool Measure Attainment of CO |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------|---|--|
| CO1: Understand the importance and applications of advanced manufacturing processes       | ✓    | ✓    | ✓    |      |      |      | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO 2: Understand the working principle and theory of material removal of various advanced |      |      |      |      |      |      |      |      |      |       |       |       | Understanding | Yes                                       | Minor Exams, Assignments, End Exams      |



|   |   |   |   |   |   |  |  |   |  |   |   |   |   |               |     |  |
|---|---|---|---|---|---|--|--|---|--|---|---|---|---|---------------|-----|--|
| machining processes   | ✓ | ✓ | ✓ |   |   |  |  | ✓ |  | ✓ | ✓ | ✓ | ✓ | Understanding | Yes | Minor Exams<br>Assignments, End<br>Exams |
| CO 3: Determine the material removal rate and surface finish achieved by various advanced machining processes | ✓ | ✓ | ✓ | ✓ | ✓ |  |  |   |  | ✓ | ✓ | ✓ | ✓ | Analysing     | Yes | Minor Exams<br>Assignments, End<br>Exams |
| CO 4: Understand the different techniques to form the miniature product from metal powder                     | ✓ | ✓ | ✓ | ✓ |   |  |  | ✓ |  | ✓ | ✓ | ✓ | ✓ | Understanding | Yes | Minor Exams<br>Assignments, End<br>Exams |
| CO 5: Learn about Additive manufacturing such as 3-D printing   | ✓ | ✓ | ✓ | ✓ |   |  |  | ✓ |  | ✓ | ✓ | ✓ | ✓ | Understanding | Yes | Minor Exams<br>Assignments, End<br>Exams |

**Paper MTME204 Computational Fluid Dynamics**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tool Measure Attainment of CO   |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------|---|--|
| CO1: Provide the student with a significant level of experience in the use of modern CFD software for the analysis of complex fluid-flow systems.                                   |      |      |      |      |      |      |      |      |      |       |       |       |               |   |  |
| CO 2: Improve the student's understanding of the basic principles of fluid mechanics.   | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding | Yes                                       | Lectures, Tutorial<br>Assignments,<br>Powerpoint<br>Presentations,<br>Numericals etc |
| CO 3: Improve the student's research and communication skills using a self-directed, detailed study of a complex fluid-flow problem and to communicate the results in written form. | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    | ✓     | ✓     | ✓     | Applying      | Yes                                       | Lectures, Tutorial<br>Assignments,<br>Powerpoint<br>Presentations,<br>Numericals etc |

**MTME –205: Advanced Welding Technology**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tool Measure Attainment of CO   |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------|---|--|
| CO1: Learn about the classification of various welding processes, welding defects and their | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding | Yes                                       | Lectures, Tutorial<br>Assignments,<br>Powerpoint<br>Presentations,<br>Numericals etc |

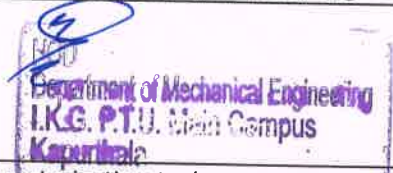
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Kapurthala

|  |   |   |   |   |   |   |   |  |   |   |   |   |               |     |   |
|--|---|---|---|---|---|---|---|--|---|---|---|---|---------------|-----|---|
| CO 2: Understand the terms weldability, soldering, brazing, welding symbols and safety and         | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  | ✓ | ✓ | ✓ | ✓ | Understanding | Yes | Lectures, Tutori<br>Assignments,<br>Powerpoint<br>Presentations<br>Numericals etc |
| CO 3: Understand the concept of various terms of welding arc such as arc efficiency, arc forces,   | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  | ✓ | ✓ | ✓ | ✓ | Understanding | Yes | Lectures, Tutori<br>Assignments,<br>Powerpoint<br>Presentations<br>Numericals etc |
| CO 4: Learn about the various types of welding electrodes, welding fluxes, shielding gases, AC and | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  | ✓ | ✓ | ✓ | ✓ | Understanding | Yes | Lectures, Tutori<br>Assignments,<br>Powerpoint<br>Presentations<br>Numericals etc |
| CO 5: Learn about various advanced welding processes along with their advantages, limitations and  | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  | ✓ | ✓ | ✓ | ✓ | Understanding | Yes | Lectures, Tutori<br>Assignments,<br>Powerpoint<br>Presentations<br>Numericals etc |

**Advanced Material Characterization MTME-207-18**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurs hip | Assessment Tool Measure Attainment of CO                            |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------|--|---|
| CO:1 apply appropriate characterization techniques for microstructure examination at different magnification level and use them to understand the microstructure of various materials | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓    | ✓     | ✓     |       | Understanding | Yes  | Minor Exams, Q<br>demonstrations thr<br>videos/ lab, End T<br>Exams |
| CO:2 choose and appropriate electron microscopy techniques to investigate microstructure of materials at high resolution  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding | Yes  | Minor Exams, Q<br>demonstrations thr<br>videos/ lab, End T<br>Exams |
| CO:3 determine crystal structure of specimen and estimate its crystallite size and stress   | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    |      | ✓    | ✓     | ✓     | ✓     | Applying      | Yes  | Minor Exams, Q<br>demonstrations thr<br>videos/ lab, End T<br>Exams |
| CO:4 apply thermal analysis techniques to determine thermal stability of and thermodynamic transitions of the specimen  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    | ✓     | ✓     |       | Applying      | Yes  | Minor Exams, Q<br>demonstrations thr<br>videos/ lab, End T<br>Exams |

**Rapid Prototyping MTME-208**



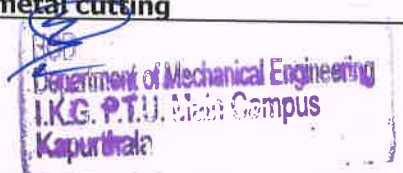


| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurs hip | Assessment Tool Measure Attainment of CO                |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------|--|---|
| CO:1 Generating a good understanding of RP history, its development and applications. Expose the students to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering. | ✓    | ✓    |      | ✓    | ✓    |      | ✓    | ✓    | ✓    | ✓     | ✓     |       | Understanding | Yes  | Minor Exams, Q demonstrations th videos/ lab, End Exams |
| CO:2 Students will be exposed to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.   | ✓    | ✓    |      | ✓    | ✓    | ✓    | ✓    |      | ✓    | ✓     | ✓     |       | Understanding | Yes  | Minor Exams, Q demonstrations th videos/ lab, End Exams |
| CO: 3 Students will understand steriolithography methods   | ✓    | ✓    |      | ✓    | ✓    |      | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding | Yes  | Minor Exams, Q demonstrations th videos/ lab, End Exams |
| CO:4 Students gain knowledge to develop prototypes using direct and indirect method of prototyping.  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    | ✓     |       |       | Understanding | Yes  | Minor Exams, Q demonstrations th videos/ lab, End Exams |

**MTME-209: Advanced metal cutting**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                       | Focus on Employability / Entrepreneurs hip | Assessment Tool Measure Attainment of CO |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------------|--|--|
| CO1: Overview of the principles of metal cutting                  | ✓    | ✓    | ✓    |      |      | ✓    | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding               | Yes  | Minor Exams, Assignments, End Exams      |
| CO 2: Describe the methods of metal cutting                       | ✓    | ✓    | ✓    |      |      | ✓    | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding               | Yes  | Minor Exams, Assignments, End Exams      |
| CO 3: Describe the cutting forces involved and their measurements | ✓    | ✓    | ✓    | ✓    |      |      | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding and Analysing | Yes  | Minor Exams, Assignments, End Exams      |
| CO 4: Describe the parameters effecting tool forces               | ✓    | ✓    | ✓    | ✓    |      |      | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding and Analysing | Yes  | Minor Exams, Assignments, End Exams      |
| CO 5: Describe the theory/methods to find tool life.              | ✓    | ✓    | ✓    | ✓    |      |      | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding and Analysing | Yes  | Minor Exams, Assignments, End Exams      |

**Paper MTME 210 Advanced Casting Processes**



| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tool Measure Attainment of CO |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------|---|--|
| CO1: Analyze and access the use of casting processes in manufacturing .   | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |      |      | ✓     | ✓     | ✓     | Understanding | Yes                                       | Minor Exams, Q Assignments, End Exams    |
| CO 2: Understand the working of various casting processes.  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |      |      | ✓     | ✓     | ✓     | Understanding | Yes                                       | Minor Exams, Q Assignments, End Exams    |
| CO 3: To inculcate the principle, thermal and metallurgical aspects during solidification of metals & alloys.                     | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |      |      | ✓     | ✓     | ✓     | Applying      | Yes                                       | Minor Exams, Q Assignments, End Exams    |
| CO 4: To impart knowledge about the principles/methods of casting with detailed design of gating/riser system needed for casting. | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |      |      | ✓     | ✓     | ✓     | Applying      | Yes                                       | Minor Exams, Q Assignments, End Exams    |
| CO 5: To impart knowledge about defects in casting objects and requirements for achieving sound casting.                          | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |      |      | ✓     | ✓     | ✓     | Applying      | Yes                                       | Minor Exams, Q Assignments, End Exams    |

### MTME-211 :Maintenance and Reliability Engineering

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tool Measure Attainment of CO |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|------------------------|---|--|
| CO1: Understand the concepts of Maintenance, Reliability and Availability.                      | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding          | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO2: Establish maintenance strategies according to system characteristics and design transition | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding          | Yes                                       | Minor Exams, Assignments, End Exams      |
| programs to implement these strategies.   | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO3: Develop fault trees for a system and apply various reliability models on fault analysis.   | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO4: Develop hazard rate models to know the behaviour of components.                            | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO5: Manage the manufacturing organisation with highest possible availability.                  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams      |

### MTME-212 : Supply Chain Management

K. J. Somaiya Institute of Technical Education  
 Vashi Campus

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                       | Focus on Employability / Entrepreneurship | Assessment Tool Measure Attainment of CO |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------------|---|--|
| CO1: Understand the supply chain performance and supply chain drivers   | ✓    |      | ✓    |      | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding               | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO2: Apply the concept of managing economies of scale in a supply chain and importance of transportation in a supply chain. | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding, Applying     | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO3: Learn about the logistics and competitive strategy and measuring logistics costs for its performance.                  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding, Applying     | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO4: Apply the concepts of benchmarking in supply chain and coordination in a supply Chain.                                 | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding, Applying     | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO5: Identify the malfunctions in rotating machinery using vibration measurements.  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding, Applying     | Yes                                       | Minor Exams, Assignments, End Exams      |
| <b>MTME-214: Engineering Design Optimization</b>  |      |      |      |      |      |      |      |      |      |       |       |       |                             |   |  |
| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                       | Focus on Employability / Entrepreneurship | Assessment Tool Measure Attainment of CO |
| CO1: Describe different methods of optimization   | ✓    | ✓    |      |      |      |      |      |      | ✓    | ✓     | ✓     | ✓     | Understanding               | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO 2: Model and formulate optimization problems in standard form and assess the optimality of a solution.                   | ✓    | ✓    | ✓    | ✓    | ✓    |      |      |      | ✓    | ✓     | ✓     | ✓     | Understanding and Analysing | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO 3: Determine the optimal solution for unconstrained and constrained problems of multiple variables.                      | ✓    | ✓    | ✓    | ✓    | ✓    |      |      |      | ✓    | ✓     | ✓     | ✓     | Understanding and Analysing | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO 4: Analyse the sensitivity of a solution to different variables.   | ✓    | ✓    | ✓    | ✓    | ✓    |      |      |      | ✓    | ✓     | ✓     | ✓     | Understanding and Analysing | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO 5: Determine the advantages and disadvantages of applying different optimization   |      |      |      |      |      |      |      |      |      |       |       |       |                             |   |  |







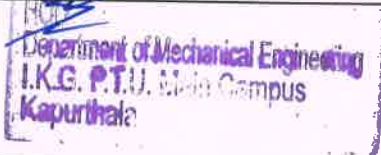
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|--|---|---|---|---|---|---|---|---|---|---|---|---|---|-------------------------|-----|-------------------------------------|
| making in sustainability.  | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Understanding, Applying | Yes | Minor Exams, Assignments, End Exams |
| CO5: Understand the environmental, economic, societal and business indicators of sustainability. | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Understanding, Applying | Yes | Minor Exams, Assignments, End Exams |

**MTME-220 Vibration and Noise Control**

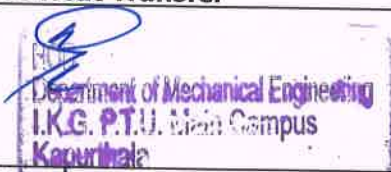
| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tool Measure Attainment of CO |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|------------------------|---|--|
| CO1: Understand the multi-degree freedom system and concept of free and forced vibrations  | ✓    | ✓    | ✓    |      | ✓    |      | ✓    | ✓    |      | ✓     | ✓     |       | Understand             | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO2: Understand the implementation of different numerical methods of multi-degree system.  |      | ✓    |      | ✓    | ✓    |      | ✓    | ✓    | ✓    |       | ✓     | ✓     | Understand             | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO3: Learn about the concepts regarding vibration of strings, bars, shafts and beams.  | ✓    |      | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓    | ✓     | ✓     |       | Understand             | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO4: Understand the concept of vibration control and measurement, vibration isolation, vibration exciters and vibration absorbers. | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓    |      | ✓    | ✓     |       | ✓     | Understand             | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO5: Learn about fundamentals of noise measurement and noise control.  | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓    |      | ✓    | ✓     |       | ✓     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams      |

**MTME-221 COMPOSITE MATERIALS**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                                 | Focus on Employability / Entrepreneurship | Assessment Tool Measure Attainment of CO |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------------------------------|---|--|
| CO1: Describe the concept, need and applications of composite materials.                         | ✓    | ✓    |      | ✓    | ✓    | ✓    | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding, Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO 2: Solve the problem of effects of influencing factors on the strength of composite materials | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |       | ✓     | ✓     | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO3: Demonstrate the various manufacturing processes of the composites                           | ✓    | ✓    |      | ✓    | ✓    | ✓    | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding, Applying               | Yes                                       | Minor Exams, Assignments, End Exams      |





|  |             |             |             |             |             |             |             |             |             |              |              |              |                        |   |   |                                     |
|--|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|------------------------|---|---|-------------------------------------|
| CO 4:Suggest/select optimum combination of Matrix/Reinforcement for various engineering applications.  | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           | ✓            | ✓            | ✓            | ✓                      | Understanding, Applying                           | Yes   | Minor Exams, Assignments, End Exams |
| <b>Design of Steam Turbines MTME-224</b>   |             |             |             |             |             |             |             |             |             |              |              |              |                        |   |   |                                     |
| <b>Course Outcome</b>  | <b>PO 1</b> | <b>PO 2</b> | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b> | <b>PO 7</b> | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b> | <b>Skill</b>           | <b>Focus on Employability / Entrepreneurs hip</b> | <b>Assessment Tool Measure Attainment of CO</b>         |                                     |
| CO:1 Students will be able to practice the basic concepts and working cycles for steam engines.  | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           | ✓            | ✓            | ✓            | Understanding          | Yes   | Minor Exams, Q demonstrations th videos/ lab, End Exams |                                     |
| CO:2 Student will be able to design the blades and impeller for impulse and reaction turbines.   | ✓           | ✓           | ✓           | ✓           | ✓           |             | ✓           | ✓           | ✓           | ✓            | ✓            | ✓            | Applying               | Yes   | Minor Exams, Q demonstrations th videos/ lab, End Exams |                                     |
| CO:3 Student will be able to identify and make different types of condensers, cooling water calculations etc.  | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |             | ✓           | ✓           | ✓            |              | ✓            | Applying               | Yes   | Minor Exams, Q demonstrations th videos/ lab, End Exams |                                     |
| <b>MTME-225 Convective Heat Transfer</b>   |             |             |             |             |             |             |             |             |             |              |              |              |                        |   |   |                                     |
| <b>Course Outcome</b>  | <b>PO 1</b> | <b>PO 2</b> | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b> | <b>PO 7</b> | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b> | <b>Skill</b>           | <b>Focus on Employability / Entrepreneurs hip</b> | <b>Assessment Tool Measure Attainment of CO</b>         |                                     |
| <br>CO1: Development of 3D-unsteady (generalized) momentum, energy and mass transfer equations in the Cartesian system, representing them in tensor and vector notations, expandable to other coordinate systems. |             | ✓           | ✓           |             | ✓           |             | ✓           | ✓           |             | ✓            | ✓            | ✓            | Understand             | Yes   | Minor Exams, Assignments, End Exams                     |                                     |
| CO2: Development of generalized Integral form of Momentum and energy equations, identification of the displacement, momentum, conduction and enthalpy thicknesses, solutions for variable free stream velocities over curved surface and for flow over a body of arbitrary shape.                  | ✓           | ✓           |             | ✓           | ✓           |             | ✓           | ✓           | ✓           |              | ✓            | ✓            | Understand             | Yes   | Minor Exams, Assignments, End Exams                     |                                     |
| CO3: Analysis of momentum and energy boundary layers in pipe flows, identification of entrance and fully developed region during laminar flow, solution of energy differential equations for constant heat flux and constant wall temperature conditions.  | ✓           |             | ✓           | ✓           | ✓           |             | ✓           | ✓           | ✓           | ✓            | ✓            |              | Applying and Designing | Yes   | Minor Exams, Assignments, End Exams                     |                                     |
| CO4: Modelling of external and internal natural convective flows and estimates of heat transfer.   | ✓           | ✓           | ✓           |             | ✓           | ✓           | ✓           |             | ✓           | ✓            |              | ✓            | Applying and Designing | Yes   | Minor Exams, Assignments, End Exams                     |                                     |

|   |   |   |   |  |   |   |   |  |   |   |  |   |                        |     |                                    |
|---|---|---|---|--|---|---|---|--|---|---|--|---|------------------------|-----|------------------------------------|
| CO5: Knowledge of turbulent heat convection, rules to modify the laminar momentum and energy equations and develop equations for the turbulent flows. | ✓ | ✓ | ✓ |  | ✓ | ✓ | ✓ |  | ✓ | ✓ |  | ✓ | Applying and Designing | Yes | Minor Exams Assignments, End Exams |
| CO6: Analyze heat exchanger performance by using the method of heat exchanger effectiveness.  | ✓ | ✓ | ✓ |  | ✓ | ✓ | ✓ |  | ✓ | ✓ |  | ✓ | Applying and Designing | Yes | Minor Exams Assignments, End Exams |

**Combustion Engineering MTME-226**

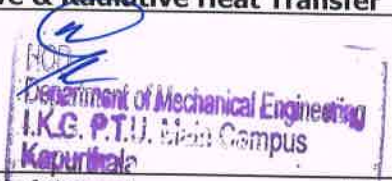
| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurs hip | Assessment Tool Measure Attainment of CO                |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------|--|---|
| CO: 1 Understand precisely a difference between premixed combustion and diffusion combustion. | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding | Yes  | Minor Exams, Q demonstrations th videos/ lab, End Exams |
| CO:2 Learn combustion mechanisms of gaseous, liquid and solid fuels                           | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding | Yes  | Minor Exams, Q demonstrations th videos/ lab, End Exams |
| CO: 3 Learn chemiluminescence phenomena of flame and the prevention method of air pollutant   | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding | Yes  | Minor Exams, Q demonstrations th videos/ lab, End Exams |

**MTME-227 Conductive & Radiative Heat Transfer**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurs hip | Assessment Tool Measure Attainment of CO |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|------------------------|--|--|
| CO1: Calculate emission of thermal radiation from a black body or grey body.  |      | ✓    | ✓    |      | ✓    |      | ✓    | ✓    |      | ✓     | ✓     | ✓     | Applying and Designing | Yes  | Minor Exams, Assignments, End Exams      |
| CO2: Calculation of view factor between two objects.  | ✓    | ✓    |      | ✓    | ✓    |      | ✓    | ✓    | ✓    |       | ✓     | ✓     | Applying and Designing | Yes  | Minor Exams, Assignments, End Exams      |
| CO3: Analyse simple radiation interchange between diffuse surfaces, radiation from a volume to a surface and an object with radiation, convection and conduction. | ✓    |      | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓    | ✓     | ✓     |       | Applying and Designing | Yes  | Minor Exams, Assignments, End Exams      |
| CO4: Understand the fundamentals of convective heat transfer process.   | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓    |      | ✓    | ✓     |       | ✓     | Understand             | Yes  | Minor Exams, Assignments, End Exams      |
| CO5: Analyze heat exchanger performance by using the method of heat exchanger effectiveness.  | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓    |      | ✓    | ✓     |       | ✓     | Applying and Designing | Yes  | Minor Exams, Assignments, End Exams      |

**MTME-229 Design of HVAC Systems**

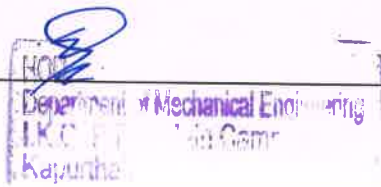
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|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Exams |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|-------|



| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tool Measure Attainment of CO |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|------------------------|---|--|
| CO1: Describe the requirement specifications for indoor air quality, energy supply and energy use.            | ✓    | ✓    | ✓    |      | ✓    |      | ✓    | ✓    |      | ✓     | ✓     |       | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO2: Describe system solutions for renewable energy production and heat storage                               |      | ✓    |      | ✓    | ✓    |      | ✓    | ✓    | ✓    |       | ✓     | ✓     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO3: Describe system solutions for ventilation and tempering of rooms   | ✓    |      | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓    | ✓     | ✓     |       | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO4: Describe solutions for domestic hot water supply, sewerage and preparation of domestic hot water methods | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓    |      | ✓    | ✓     |       | ✓     | Understand             | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO5: Describe the components of HVAC system.  | ✓    | ✓    | ✓    |      | ✓    | ✓    | ✓    |      | ✓    | ✓     |       | ✓     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams      |
| CO6: Describe the content of solutions for monitoring and control of air conditioning plants                  |      | ✓    | ✓    |      | ✓    | ✓    | ✓    |      | ✓    | ✓     | ✓     | ✓     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Exams      |

**Design and optimization of Thermal Systems MTME-230**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tool Measure Attainment of CO                   |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------|---|--|
| CO:1 Integrate thermal component models and simulate a thermal system | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding | Yes                                       | Minor Exams, Q demonstrations thr videos/ lab, End T Exams |
| CO:2 Perform an economic analysis of a thermal system.                | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    |      | ✓    | ✓     | ✓     | ✓     | Applying      | Yes                                       | Minor Exams, Q demonstrations thr videos/ lab, End T Exams |
| CO:3 Use the computer to solve thermal system models                  | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    |      | ✓    | ✓     | ✓     | ✓     | Applying      | Yes                                       | Minor Exams, Q demonstrations thr videos/ lab, End T Exams |
| CO:4 Communicate thermal system designs both orally and in writing    | ✓    | ✓    | ✓    | ✓    | ✓    |      | ✓    |      | ✓    | ✓     | ✓     | ✓     | Understanding | Yes                                       | Minor Exams, Q demonstrations thr videos/ lab, End T Exams |





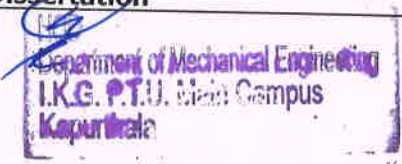
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|---|---|---|---|---|---|--|---|--|---|---|---|---|----------|-----|---|
| CO:5 Apply optimization procedures and design optimized thermal systems | ✓ | ✓ | ✓ | ✓ | ✓ |  | ✓ |  | ✓ | ✓ | ✓ | ✓ | Applying | Yes | Minor Exams, Q demonstrations th videos/ lab, End Exams |
|---|---|---|---|---|---|--|---|--|---|---|---|---|----------|-----|---|

**MTME-301 :Project**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurs hip | Assessment Tool Measure Attainment of CO |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|------------------------|--|--|
| CO1: Identify an engineering problem, devise a means of solving and exhibit the ability to execute the solution. | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |       | ✓     | ✓     | Understanding          | Yes  | Reports, Project Presentations and Viva  |
| CO2: Demonstrate knowledge of professional and ethical responsibilities  | ✓    |      | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Applying and Designing | Yes  | Reports, Project Presentations and Viva  |
| CO3: Formulate and implement innovative ideas for social and environmental benefits.                             | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Applying and Designing | Yes  | Reports, Project Presentations and Viva  |
| CO4: Write technical report of the project apart from developing a presentation.                                 | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Applying and Designing | Yes  | Reports, Project Presentations and Viva  |
| CO5: Demonstrate an ability to present and defend their research work to a panel of experts.                     | ✓    |      | ✓    |      | ✓    | ✓    | ✓    |      | ✓    | ✓     | ✓     | ✓     | Applying and Designing | Yes  | Reports, Project Presentations and Viva  |

**Paper MTME404 Dissertation**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurs hip | Assessment Tool Measure Attainment of CO      |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------|--|---|
| CO1: Demonstrate a depth of knowledge of Mechanical Engineering.   | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding | Yes  | Field Project, Report Making and Presentation |
| CO 2: Complete an independent research project, resulting in at least a thesis publication, and research outputs in terms of publications in high impact factor journals, conference proceedings and patents | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Applying      | Yes  | Field Project, Report Making and Presentation |
| CO 3: Demonstrate knowledge of contemporary issues in their chosen field of research.  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding | Yes  | Field Project, Report Making and Presentation |
| CO4: Demonstrate an ability to present and defend their research work to a panel of experts.   | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓     | ✓     | ✓     | Understanding | Yes  | Field Project, Report Making and Presentation |



**Research Methodology (Phd. Course Work)**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|------------------------|---|--|
| CO1: Formulate a research problem                                    | √    | √    | √    | √    | √    | √    | √    | √    | √    |       | √     | √     | Understand             | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO 2: Explain the different experimental designs and their analysis. | √    | √    | √    | √    | √    | √    | √    | √    | √    | √     | √     | √     | Understand             | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO 3: Apply different statistical tools for the research analysis    | √    | √    | √    | √    | √    | √    | √    | √    | √    | √     | √     | √     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO 4: Apply the research ethics                                      | √    |      | √    | √    | √    | √    | √    | √    | √    | √     | √     | √     | Applying and Designing | Yes                                       | Assignments, Presentations and Final Viva    |

**Non Conventional Machining (PhD Course Work)**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|------------------------|---|--|
| CO1: Understand the need of Non Conventional Machining Processes and able to Classify various processes.                                  | √    | √    | √    |      | √    |      | √    | √    | √    | √     |       | √     | Understand             | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO2: Recognize the role of mechanical energy in non-Conventional machining processes.   |      | √    |      | √    |      |      | √    | √    | √    |       | √     | √     | Understand             | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO3: Apply the knowledge on machining electrically conductive material through electrical energy in non-Conventional machining processes. | √    |      | √    | √    |      | √    | √    | √    |      | √     | √     |       | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |
| CO4: Understand the concept of machining the hard material using chemical energy and electrochemical energy.                              |      | √    | √    |      |      |      | √    | √    | √    | √     |       | √     | Applying and Designing | Yes                                       | Assignments, Presentations and Final Viva    |
| CO5: Apply the knowledge on machining electrically conductive material through electrical energy in non-Conventional machining processes. |      |      |      |      |      |      |      |      | √    | √     |       | √     | Applying and Designing | Yes                                       | Minor Exams, Assignments, End Term Exams     |

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|  |   |  |   |   |   |   |   |   |   |   |   |   |   |                        |     |  |
|--|---|--|---|---|---|---|---|---|---|---|---|---|---|------------------------|-----|--|
| CO6: Familiarity and application of various thermal energy based non-conventional machining processes. | √ |  | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | Applying and Designing | Yes | Minor Exams, Assignments, End Term Exams |
|--|---|--|---|---|---|---|---|---|---|---|---|---|---|------------------------|-----|--|

**PhD Paper Presentation/Seminar**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill    | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO               |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|----------|---|--|
| CO1: Deal with nerves and think more positively about public speaking.                                     | √    | √    | √    |      | √    | √    | √    | √    | √    | √     | √     | √     | Thinking | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO 2: Consider ways of grabbing the listener's attention, holding their interest, and concluding strongly. | √    |      | √    |      |      | √    | √    | √    | √    | √     | √     | √     | Thinking | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO3: Use body language and tone of voice to enhance their presentations.                                   |      |      | √    |      | √    | √    | √    | √    | √    | √     | √     | √     | Applying | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO4: Use slides and visual aids effectively.   | √    | √    | √    |      | √    | √    | √    | √    | √    | √     | √     | √     | Applying | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO5: Deliver an enthusiastic and well-practised presentation.  | √    | √    | √    |      | √    | √    | √    | √    | √    | √     | √     | √     | Applying | Yes                                       | Field based assignments, Report making, presentations etc. |

**Advanced Heat Transfer**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill    | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO               |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|----------|---|--|
| CO1: Understand the principles of heat transfer through conduction, convection and radiation modes.        | √    | √    | √    |      | √    | √    | √    |      | √    | √     | √     | √     | Thinking | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO2: Understand the heat transfer during phase-change processes, such as boiling and condensation.         | √    | √    | √    |      |      | √    |      | √    | √    | √     | √     | √     | Thinking | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO3: Understand the practical aspects of the theories of heat transfer, such as design of heat exchangers. | √    |      | √    |      | √    | √    | √    | √    | √    |       | √     | √     | Applying | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO4: Understand the concept related to mass transfer and its connection with heat transfer.                |      | √    | √    |      | √    | √    | √    | √    |      | √     | √     | √     | Applying | Yes                                       | Field based assignments, Report making, presentations etc. |

|  |  |   |   |   |   |   |   |   |   |   |   |   |          |     |  |
|--|--|---|---|---|---|---|---|---|---|---|---|---|----------|-----|--|
| CO5: Carry out laboratory tests verifying the various principles of heat transfer. |  | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | Applying | Yes | Field based assignments, Report making, presentations etc. |
|--|--|---|---|---|---|---|---|---|---|---|---|---|----------|-----|--|

**Advanced Fluid Mechanics and CFD**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO               |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------|---|--|
| CO1: Understand the concept of computational fluid dynamics, modeling and simulation.   | √    | √    | √    |      | √    | √    | √    |      | √    |       | √     | √     | Understanding | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO2: Learn about the different governing equations of fluid dynamics.   | √    |      | √    |      |      |      |      | √    | √    | √     | √     | √     | Thinking      | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO3: Understand the concept of parabolic, elliptic and hyperbolic equations and various methods of finite differencing and stability. |      |      | √    |      | √    | √    | √    | √    | √    |       | √     | √     | Applying      | Yes                                       | Field based assignments, Report making, presentations etc. |
|   |      | √    | √    |      | √    | √    | √    | √    |      | √     | √     | √     | Understanding | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO4: Understand the concept of turbulence, error and uncertainty & different turbulent  | √    | √    | √    |      | √    | √    | √    |      | √    | √     |       |       | Applying      | Yes                                       | Field based assignments, Report making, presentations etc. |

**Finite Elements Methods**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill     | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO               |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------|---|--|
| CO1: To obtain an understanding of the fundamental theory of the FEA method;  | √    |      | √    | √    | √    | √    | √    |      | √    | √     | √     | √     | Thinking  | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO2: To develop the knowledge of mathematics and engineering in solving the problems related to structural and heat transfer. | √    |      | √    |      |      | √    |      | √    | √    | √     | √     | √     | Designing | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO3: To identify the application and characteristics of FEA elements such as bars, beams, plane and isoparametric elements    |      | √    | √    | √    | √    | √    | √    | √    | √    |       |       | √     | Applying  | Yes                                       | Field based assignments, Report making, presentations etc. |

|   |   |   |   |   |   |   |   |   |   |   |   |   |               |     |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---------------|-----|--|
| CO4: To understand the application and use of the FE method for heat transfer problems                              |   | √ | √ | √ | √ | √ | √ | √ |   | √ | √ | √ | Understanding | Yes | Field based assignments, Reporting, presentations etc. |
| CO5: Use the commercial FEA packages like ANSYS and modern CAD/CAE tools for solving real life structural problems. | √ | √ | √ |   | √ | √ | √ | √ | √ | √ |   | √ | Applying      | Yes | Field based assignments, Reporting, presentations etc. |

### Composite Materials

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill         | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO           |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|---------------|---|--|
| CO1: Describe the concept, need and applications of composite materials.                            |      |      | √    | √    | √    | √    | √    |      | √    | √     | √     | √     | Thinking      | Yes                                       | Field based assignments, Reporting, presentations etc. |
| CO 2: Solve the problem of effects of influencing factors on the strength of composite materials    | √    |      | √    |      |      | √    |      | √    | √    | √     | √     | √     | Designing     | Yes                                       | Field based assignments, Reporting, presentations etc. |
| CO3: Demonstrate the various manufacturing processes of the Metal/ceramic/polymer-based composites. | √    | √    | √    | √    | √    | √    | √    | √    | √    |       | √     | √     | Applying      | Yes                                       | Field based assignments, Reporting, presentations etc. |
| CO 4: Test and characterize the composite and suggest secondary processing as per application.      | √    | √    | √    |      | √    | √    | √    | √    |      | √     | √     | √     | Understanding | Yes                                       | Field based assignments, Reporting, presentations etc. |

### Optimization Techniques

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill     | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO           |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------|---|--|
| CO1: Ability to apply the theory of optimization methods and algorithms to develop and for solving various types of optimization problems | √    |      | √    | √    | √    | √    | √    |      | √    | √     | √     | √     | Thinking  | Yes                                       | Field based assignments, Reporting, presentations etc. |
| CO2: Ability to go in research by applying optimization techniques in problems of Engineering and Technology                              |      | √    | √    |      |      | √    |      | √    | √    | √     | √     | √     | Designing | Yes                                       | Field based assignments, Reporting, presentations etc. |




|   |   |   |   |   |   |   |   |   |   |   |   |   |   |          |     |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----------|-----|--|
| CO3: Ability to solve the mathematical results and numerical techniques of optimization theory to concrete Engineering problems by using computer software. | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | Applying | Yes | Field based assignments, Reporting, presentations etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----------|-----|--|

**Computer Aided Design and Manufacturing (CAD/CAM)**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO           |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|------------------------|---|--|
| CO1: Apply/develop solutions or to do research in the areas of Design and simulation in Mechanical Engineering.  | √    | √    | √    | √    | √    | √    | √    |      | √    | √     | √     | √     | Understand             | Yes                                       | Field based assignments, Reporting, presentations etc. |
| CO2: Have abilities and capabilities in developing and applying computer software and hardware to mechanical design and manufacturing fields.  | √    | √    | √    |      |      | √    |      | √    | √    | √     | √     | √     | Understand             | Yes                                       | Field based assignments, Reporting, presentations etc. |
| CO3: Review and document the knowledge developed by scholarly predecessors and critically assess the relevant technological issues.  |      |      | √    | √    | √    | √    | √    | √    | √    |       | √     | √     | Applying and Designing | Yes                                       | Field based assignments, Reporting, presentations etc. |
| CO4: Formulate relevant research problems; conduct experimental and/or analytical study and analyzing results with modern mathematical/scientific methods and use of software tools. |      | √    | √    | √    | √    | √    | √    | √    |      | √     | √     | √     | Applying               | Yes                                       | Field based assignments, Reporting, presentations etc. |

**Advanced Theory of Vibrations**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill      | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO           |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|------------|---|--|
| CO1: Recognize the need and measurement of vibration in mechanical systems | √    |      | √    | √    |      | √    | √    |      | √    | √     | √     | √     | Understand | Yes                                       | Field based assignments, Reporting, presentations etc. |
| CO2: Suggest suitable methods of vibration reduction and absorption        | √    | √    | √    |      |      | √    |      | √    | √    | √     | √     | √     | Understand | Yes                                       | Field based assignments, Reporting, presentations etc. |

  
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|--|---|---|---|---|--|---|---|---|---|---|---|---|------------------------|-----|--|
| CO3: Calculate natural frequencies of vibrations                     |   | √ | √ | √ |  | √ | √ | √ | √ |   | √ | √ | Applying and Designing | Yes | Field based assignments, Report making, presentations etc. |
| CO4: Distinguish between systems with different degrees of vibration | √ | √ | √ | √ |  | √ | √ | √ |   | √ | √ | √ | Applying               | Yes | Field based assignments, Report making, presentations etc. |

### Tribology

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO               |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|------------------------|---|--|
| CO1: Be able to know the field of tribology.   | √    | √    | √    | √    | √    | √    |      |      | √    | √     | √     | √     | Understand             | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO2: Be able to know the surface, properties of surface and related instruments                                      | √    | √    | √    |      | √    | √    |      | √    | √    | √     | √     | √     | Understand             | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO3: Be able to understand the friction, friction theory and behaviour of metals and non-metals                      |      |      | √    | √    | √    | √    |      | √    | √    |       | √     | √     | Applying and Designing | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO4: Be able to understand wear processes, wear theory, behaviour of metals and non-metals and different instruments | √    | √    | √    | √    |      | √    | √    | √    |      | √     | √     | √     | Applying               | Yes                                       | Field based assignments, Report making, presentations etc. |

### Thermo Economics and Power Plants

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill    | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO               |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|----------|---|--|
| CO1: Understand and know the requirements for a Thermal Power Plant and Nuclear Power Plant, from sources to consumption and economics of power plants | √    |      | √    | √    | √    | √    | √    | √    | √    | √     | √     | √     | Thinking | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO2: Study and learn the processes and cycles followed in Thermal Power Plants and nuclear power plants and components used in the power plants.       | √    | √    | √    |      | √    | √    |      | √    | √    | √     | √     | √     | Thinking | Yes                                       | Field based assignments, Report making, presentations etc. |



|  |   |   |   |   |   |   |   |   |   |   |   |   |   |          |     |  |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|----------|-----|--|
| CO3: Apply the knowledge gained by analyzing the steam power plants, steam generators and gas turbine power plants, to improve the efficiency and reduce the thermal losses. |   |   | √ | √ | √ | √ | √ |   | √ | √ |   | √ | √ | Applying | Yes | Field based assignments, Report making, presentations etc. |
| CO4: Apply the knowledge in calculating the Power Load Calculations and Distribution.  | √ | √ | √ | √ |   | √ | √ | √ |   | √ | √ | √ |   | Applying | Yes | Field based assignments, Report making, presentations etc. |

**Advanced Thermodynamics**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO               |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|------------------------|---|--|
| CO1: Describe the various laws of thermodynamics and their applications  | √    | √    |      | √    | √    | √    | √    |      | √    | √     | √     | √     | Understand             | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO 2: Explain the concepts of availability and irreversibility with respect to reacting and nonreacting systems. |      |      |      |      | √    | √    |      |      | √    | √     | √     | √     | Understand             | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO 3: Describe methods in using equations of potentials, availability, and exergy for thermodynamic analysis.    | √    | √    |      | √    | √    | √    |      |      | √    |       | √     | √     | Applying and Designing | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO 4: Explain the behaviour of gases and chemical equilibrium.   | √    | √    |      | √    |      | √    | √    |      |      | √     | √     | √     | Applying               | Yes                                       | Field based assignments, Report making, presentations etc. |

**Presentation/Seminar**

| Course Outcome   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill    | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO               |
|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|----------|---|--|
| CO1: Deal with nerves and think more positively about public speaking.                                     |      | √    | √    | √    | √    | √    | √    |      | √    | √     | √     | √     | Thinking | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO 2: Consider ways of grabbing the listener's attention, holding their interest, and concluding strongly. | √    |      |      |      | √    | √    |      |      | √    | √     | √     | √     | Thinking | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO3: Use body language and tone of voice to enhance their presentations.                                   | √    | √    | √    | √    | √    | √    |      |      | √    |       | √     | √     | Applying | Yes                                       | Field based assignments, Report making, presentations etc. |

|  |   |   |   |   |   |   |  |  |   |   |   |         |     |  |
|--|---|---|---|---|---|---|--|--|---|---|---|---------|-----|--|
| CO4: Use slides and visual aids effectively. | √ | √ | √ | √ | √ | √ |  |  | √ | √ | √ | Applyir | Yes | Field based assignments, Report making, presentations etc. |
|--|---|---|---|---|---|---|--|--|---|---|---|---------|-----|--|

**Production Engineering**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO               |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|------------------------|---|--|
| CO1: Understand the various Conventional and Non-Conventional machining processes | √    |      | √    | √    | √    |      | √    |      | √    | √     | √     | √     | Understand             | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO2: Learn about measuring equipment, error types and their evaluation            | √    | √    | √    | √    | √    |      |      |      | √    | √     | √     | √     | Understand             | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO3: Learn about process capability and six sigma                                 |      | √    | √    | √    | √    |      |      |      | √    |       | √     | √     | Applying and Designing | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO4: Learn about quality control and quality assurance systems                    | √    | √    | √    | √    |      |      | √    |      |      | √     | √     | √     | Applying               | Yes                                       | Field based assignments, Report making, presentations etc. |

**Advanced Mechanics of Solids**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO               |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|------------------------|---|--|
| CO1: Understand concepts of stress and strain in solids and associated theories of failure.   | √    |      | √    | √    | √    |      | √    |      | √    | √     | √     | √     | Understand             | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO2: Derive governing equations to solve engineering problem.   | √    | √    |      |      | √    |      |      |      | √    | √     | √     | √     | Understand             | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO3: Apply analysis techniques to determine stress in components such as shafts, beams, shells and rotating discs under different loading conditions. |      | √    | √    | √    | √    |      |      |      | √    |       | √     | √     | Applying and Designing | Yes                                       | Field based assignments, Report making, presentations etc. |
| CO4: Analyze deformations in beam and locate shear centre in thin-walled beams.   | √    | √    | √    | √    |      |      | √    |      |      | √     | √     | √     | Applying               | Yes                                       | Field based assignments, Report making, presentations etc. |


**Mechatronics**

| Course Outcome | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO |
|----------------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|---|--|
|----------------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|---|--|

|   |   |   |   |   |   |   |   |   |   |   |   |   |          |     |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|----------|-----|--|
| CO1: Each individual should develop competence in technologies of automation.       | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | Thinking | Yes | Field based assignments, Reporting, presentations etc. |
| CO2: Capable to develop simple control systems and study the system response.       | √ | √ |   |   | √ |   |   | √ | √ | √ | √ | √ | Thinking | Yes | Field based assignments, Reporting, presentations etc. |
| CO3: Individual should be able to understand the communication system in automation |   | √ | √ | √ | √ |   |   |   |   |   |   | √ | Applying | Yes | Field based assignments, Reporting, presentations etc. |
| CO4: Analyze deformations in beam and locate shear centre in thin-walled beams.     | √ |   | √ | √ |   |   | √ | √ | √ | √ | √ | √ | Applying | Yes | Field based assignments, Reporting, presentations etc. |

**Product Design and Development**

| Course Outcome  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | Skill                  | Focus on Employability / Entrepreneurship | Assessment Tools to Measure Attainment of CO           |
|---|------|------|------|------|------|------|------|------|------|-------|-------|-------|------------------------|---|--|
| CO1: To introduce the objects of product design and requirements of a good product design.  |      | √    | √    | √    | √    | √    | √    | √    | √    | √     | √     | √     | Understand             | Yes                                       | Field based assignments, Reporting, presentations etc. |
| CO2: Knowledge of different design principles like designing for function, production, installation and handling, maintenance, packing etc. | √    | √    |      |      | √    | √    |      | √    | √    | √     | √     | √     | Understand             | Yes                                       | Field based assignments, Reporting, presentations etc. |
| CO3: Knowledge and use of latest CAD/CAM/CAE software for different design and development functions.                                       | √    | √    | √    | √    | √    | √    |      |      |      |       | √     | √     | Applying and Designing | Yes                                       | Field based assignments, Reporting, presentations etc. |

  
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