# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

## DEPARTMENT OF MECHANICAL ENGINEERING

### ACTION TAKEN TOWARDS STAKE HOLDERS' FEEDBACK ON THE CURRICULUM

### 2021-22



PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

**Chaitanya Bharathi Institute of Technology, Gandipet, Hyderabad-75**
**Department of Mechanical Engineering**

**Action taken report on**

**Student's feedback - 2021-22 (Through Programme exit survey)**

To
The director (IQAC)
CBIT

**Subject:** Consolidation of the strengths, weaknesses pointed by the Mechanical Engineering students of 2022 pass out and the action plan-regarding.
Ref: Mail from your office dt 15.06.2022, 4.20 p.m.
The following are the strengths and suggestions came out from the programme exit survey of Mechanical Engineering students passed out in 2021-22

**I. Strengths**

1. Faculty, Syllabus and Mentoring
2. Faculty are supportive, encouraging, experienced
3. Good communication skills. Good in problem solving. Excellent knowledge on subject
4. lectures and Labs
5. Discipline dedication
6. Informative Motivational Satisfactory
7. MED main strength is its dedicated professors. I still remember Radha Krishna sir taking online classes after college hours on my personal request. Seshagiri sir taught us when he got Covid. He was unwell and had breathing problem. Yet he taught us TTM 2. Syllabus coverage on time. 3. Application oriented teaching. Certain professors like Solomon sir, Jaipal sir taught us real life application-based concepts even if they are not in portion. They also ensured that they covered syllabus on time
8. Teachers
9. Communication, Integrity and Knowledge
10. Faculty
11. Excellent teaching staff, Great laboratories interesting subjects
12. Department is helpful, The professors and the LABs

II. **Comments/Suggestions**

| S.No | Comments / suggestions from the students | Corrective action proposed | Responsibility |
|---|---|---|---|
| 1. | Health centre as per our observations is not available in necessary situations. It should be the first priority for helping any of the institution member. Also transport department can be improved. | As it comes under common amenities, the same is represented to the principal through Director IQAC through this document | HoD |
| 2. | Real world exposure should be provided through curriculum | Efforts are made to formulate the syllabus to take care of industrial needs of current day. In the recent curricular revision the | Chairman, BoS |

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
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| | | feedback from the alumni, students and recruiters was taken and the necessary changes were incorporated. The same will be continued further | |
| 3. | more equipment and opportunities to showcase the talent,<br>More opportunities to students to real world problems. | As per the department's perceptive and the comments by the NBA expert during recent NBA accreditation visit, the equipment is sufficient for academic purpose, but not sufficient for research. The department is stiving to procure the equipment for research. In this regard a proposal is submitted to higher authorities. | HoD |
| 4. | 1.Benches are very old.<br>2. Try to install smart boards in every classes like room no E202. | As it comes under common amenities, the same is represented to the principal through Director IQAC through this document | HoD |
| 5. | 1. College website is not good i.e student info is not working properly.<br>2. It will be great if R and D block canteen is opened and increase the size of canteen which is below placement block.<br>3. Provide placement training for core branches like mech, civil, eee. | As it comes under common amenities/corrective actions/ preventive actions , the same is represented to the principal through Director IQAC through this document | HoD |
| 4. | Wifi must be available | As it comes under common amenities, the same is represented to the principal through Director IQAC through this document | HoD |
| 5. | Everything is good with college except transportation fees and placement drive. | As it comes under common amenities, the same is represented to the principal through Director IQAC through this document | HoD |
| 6. | Placement drive is worst. Rules are changed frequently. Mechanical placement coordinators are the worst of all and not at all satisfactory in any aspect. They are in such a worst state that they are not even able to classify a company under core or IT. We are unable to know the job role. Forms are sent and deadline is not even 12 hours for many forms. Sufficient time is not given to fill | As it comes under common amenities/corrective actions/ preventive actions, the same is represented to the principal through Director IQAC through this document | HoD |

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PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

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| | the forms and apply for company. PCs and Placement Head are not allowing me to appear for other placement exams. Salary package of ITC company is 8.5 LPA. As I got placed in HCL, I'm not allowed for ITC but HCL package is 5.5 LPA. Employment offer is not confirmed because of the following reason. I started my internship from 22nd February 2022. They asked us to shift to Chennai from 2nd May for offline work. I requested them to provide work from home through online option as we had Project reviews, mid exams etc. They didn't accept. I lost internship because of not going to Chennai. HCL is not giving clarity on full time employment offer as I lost my internship. PCs & Placement Head should solve this issue and help me but they are least bothered. We are not even clear about job role. It is nowhere clear that whether HCL is offering IT role or core job. PCs should not be selfish and they should give clarity. Placement Head didn't lift my call even after calling 4 to 5 times. I tried to contact him to solve this issue. But instructions are being passed stating not to appear for further placements. Either HCL should be solved or I should be allowed to appear for further companies. Transport fees is too high. Washrooms can be more hygienic. | | |
| 7. | Please add more technical seminars and field visits for more practical knowledge. | In R-20, there are one project seminar and one technical seminar in the curriculum. In addition to it, students present review seminars for the project in VIII semester. Moreover, Course end project/ Open ended problem/ Case Study/Assignments constitute 25% percent of CIE. Under CIE, possibility of introduction of course seminars will be discussed during the next revision. | Chairman, Bos |

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

**III.Feedback obtained through structured questions:**

1. All POs scored more than 70%
2. Library facilities, computing facilities, Admin and account section services, AEC services, COE, Campus placement opportunities, curriculum scored more than 70%.
3. Internet facilities, transportation facilities, wash rooms, games and sports facilities, canteen facilities, hostel facilities, training for placement, career guidance, extracurricular opportunities, motivation towards R&D scored less than 70%. It is hereby submitted to the office of Director (IQAC) for necessary action and directions if any to the department of Mechanical Engineering to improve the score on the facilities stated above.

Head, MED

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

## VII. Assessment Procedures for Awarding Marks

The distribution of marks is based on CIE and the Semester End Examination shall be as follows:

| Course (in terms of credits) | CIE | Semester End Examination(SEE) | Remarks | Duration of Semester End Examination |
|---|---|---|---|---|
| Three(3) Credits/ Four(4) Credits | 40 | 60 | Theory Course | 3 Hours |
| Two and Half Credits(2.5) | 50 | 50 | CAD& Drafting/Workshop | 3 Hours |
| Two(2) Credits | 40 | 60 | Theory | 3 Hours |
| Three (3),Two(2) Credits/One and Half(1.5) Credits | 50 | 50 | Lab Course/Workshop | 3 Hours |
| One(1) Credit | 50 | 50 | Lab Course | 3 Hours |
| Two(2) Credits | 50 | --- | Project Part 1 | ---- |
| Four (4) Credits | 100 | 100 | Project Part 2 | Viva |
| One (1) Credit | 50 | --- | Technical Seminar | ---- |
| One(1) Credit | 50 | --- | Mini Project | ---- |
| Non- Credit | --- | 50* | Environmental Sciences, Indian Constitution and Essence of Indian Traditional Knowledge | 2 Hours |

*Pass/Fail**CIE: Continuous Internal Evaluation (Max. Marks: 40)**

| S. No | Assessment Tool | No. of tests | Description | Max. Marks | Remarks |
|---|---|---|---|---|---|
| 1 | Class Tests | 2 | Average of two tests, each of 20 marks | 20 | |
| 2 | a) Course end project/ Open ended problem/ Case Study | 1 | Evaluation as per the assessment rubrics (minimum 2 reviews) | 10 | Assessment methods either (a) or (b) can be opted as per the scope. |
| | b) Assignments(should be from BL4 and BL5) | 2 | Average of two assignments, each of 10 marks | | |
| 3 | Slip Tests | 3 | Three slip tests and average of the best two slip tests | 5 | |
| 4 | Attendance | 5 | 5 marks >=85% ; 4 marks >=80%; 3 marks >=75%; 2 marks >=70%; 1 marks >=65%. | 5 | |
| | Total marks | | | 40 | |

The SEE question paper will contain two parts, Part-A and Part-B. Part- A contains five (5)*questions (15 marks), one from each unit carrying a weightage of 3 marks. Part-B carries 45

PROFESSOR & HEAD
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# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

## DEPARTMENT OF MECHANICAL ENGINEERING

## Action taken report on Faculty Feedback

### 2021-22

| S. No | Description | Action Taken/Proposed | Page No |
|---|---|---|---|
| 1 | Mr Aditya TN Suggested the addition of Cycloids Involutes and Epycycloids can be added in CAD & Drafting | Cycloids and involutes were there in R-16 , but as the manual drawing changed computerized one and AutoCAD needs to be taught, the same is discarded to provide the scope of training on AutoCAD in R-20. Hence it could not be done. | 10 |
| 2 | Dr.B.V.S. Rao suggested that 4D printing fundamentals material applications and challenges are to included in manufacturing processes | 3D printing was added in R-20. 4D printing may be considered in next revision | 11-12 |
| 3 | Dr. G. Laxmaiah suggested matrix iteration method and jocobi method can be added in dynamics of machines | Incorporated in syllabus | 13-14 |
| 4 | Dr. T. Ratna Reddy suggested that order of the topics to be changed in CFD subject | The same was done. | 15-16 |
| 5 | Ch. Sharath Reddy, suggested inventory topic can be included in operations research subject | Inventory topic is already there in Production and Operation Management. | 17-18 |
| 6 | Dr. Y.S. Kannan suggested include plumbing trade in workshop | Included in the syllabus | 19-20 |
| 7 | V. Venkatesu, suggested conceptual design should be focused in engineering exploration<br>Industrial sketching techniques are to be included in CAD & Drafting subject<br>Design for Additive manufacturing concepts should include in Additive manufacturing subject<br>Robotic pick and place robot experiments are to be included, robotic simulator is needed | Engineering Exploration course is replaced by Robotics and Drones Lab. | 21-22 |

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
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| 8 | Mr P Kiran Kumar suggested to allot Five Hours per work for CAD&D instead of Four hours. | Due to the credit adujstement in R-20 CAD&D lab was made for 4 hrs instead of 3 hrs | 23 |
| 9 | Ms Indira Priya Darsini suggested include solar radiation measuring instrument in Renewable Energy sources | Included in the syllabus | 24-25 |
| 10 | Dr P. Rama Lakshmi suggested for fluid flow may be included along with fluid flow problem CAE. | Will be considered in the next revision | — |
| 12 | Ms Indira Priya Darsini suggested to add boilers and cooling towers can be included in Power Plant Engineering | Will be considered in the next revision | — |
| 13 | Ms Indira Priya Darsini suggested to include MAT Lab experiments in CFD Lab | Will be considered during further revision | — |
| 14 | Dr S .Narsimha Kumar suggest to include normal shock problems in Themal turbo Machines subject and Wind Tunnel Experiment is also included. | Included in the syllabus | 26-29 |
| 15 | Dr R P Chowdary suggest to increase the concepts of wind energy in DSWS. | Can be added in the next revision | — |
| 16 | Dr Aleem Pasha suggested to SEM, TEM Analysis and Fracture Text in MSM subject | It will be considered in next revision | — |
| 17 | Dr.Kiran Kumar Ammireddy suggested Numerical Control of Machine Tools and Taper and Step Turning Experiment are to be added in CAD/CAM. | The topics are there but the experiments are to be separated. It can be taken care in the next revision | — |
| 18 | Ms N. Jyothirmayi suggested including topic related to financial management and delete project management techniques in IAFM course. | Will put forward in Program assessment committee for finalization | — |
| 19 | Mr Chandra Kanth suggested to include topics of Economics of Machining and Maximum Profit criteria and Micro Machining in MCMTE and exercise on shaper Machine to make a V Block in Lab. | Will be considered in next revision | — |

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

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| 20 | Mr Chandra Kanth suggested to add E Manufacturing Concept in CIM Subject | The topic was there in digital manufacturing course | 30-31 |
| 21 | Dr MVS Murali Krishna Suggested to add Heat Pipe Design and Conjugative Heat Transfer in advance Heat & Mass Transfer | It was there in R-19. Heat pipe was an outdated topic and conuctive heat transfer is one of the topic in AHMT in II sem. | 32-33 |
| 22 | Dr MVS Murali Krishna Suggested Fenno & Rayleigh waves are to be introduced and remove oblique shocks in advanced fluid dynamics | The topics are available in TTM during II sem | 34-35 |

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

with effect from the Academic Year 2020-21

**20ME C01**

## CAD AND DRAFTING

| | |
|---|---|
| Instruction | 1 T + 3 D Hours per week |
| Duration of SEE | 3Hours |
| SEE | 50Marks |
| CIE | 50Marks |
| Credits | 2.5 |

**Course Objectives:**

1. To get exposure to a cad package and its utility.
2. Understanding orthographic projections.
3. To visualize different solids and their sections in orthographic projection
4. To prepare the student to communicate effectively by using isometric projection.
5. To prepare the student to use the techniques, skills, and modern tools necessary for practice.

**Outcomes:** At the end of the course, the Students are able to

1. Become conversant with appropriate use of CAD software for drafting. (BL-3)
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting. (BL-2)
3. Construct the projections of points, lines, planes, solids (BL-3)
4. Analyse the internal details of solids through sectional views (BL-4)
5. Create an isometric projections and views (BL-6)

**List of Exercises:**

1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
2. Construction of Conic Sections by General method
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Isometric projections and views
13. Conversion of isometric views to orthographic projections and vice versa.

**Text Books:**


1. N.D.Bhatt, "Elementary Engineering Drawing", Charotar Publishers, 2012.
2. K.Venugopal, "Engineering Drawing and Graphics + AutoCAD", New Age International Pvt. Ltd,2011.
3. Basanth Agrawal and C M Agrawal, "Engineering Drawing", 2/e, McGraw-Hill Education (India) Pvt. Ltd.


**Suggested Reading:**


1. Shaw M.B and Rana B.C., "Engineering Drawing", 2/e, Pearson, 2009.
2. K.L. Narayana and P.K. Kannaiah, "Text Book of Engineering Drawing", Scitech Publications, 2011.


PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

**20MEC06**

## MANUFACTURING PROCESSES

| | |
|---|---|
| Instruction | 4 L Hours per Week |
| Duration of SEE | 3 Hours |
| SEE | 60 Marks |
| CIE | 40 Marks |
| Credits | 4 |

**Objectives:** To enable the students to

1. Understand various terms related to manufacturing processes
2. Understand various manufacturing processes
3. Provide the ability to solve simple problems such as riser design and sheet metal calculations
4. Compare various Manufacturing processes
5. Select suitable manufacturing process for a given component

**Outcomes:** At the end of the course, a student will be able to

1. Define various terms related to manufacturing processes
2. Demonstrate the understanding of various manufacturing processes
3. Solve simple problems such as riser design and sheet metal calculations
4. Compare various manufacturing processes
5. Choose suitable manufacturing process for a given component

**UNIT – I**

**Manufacturing Processes:** Classification and importance.

**Casting:** Introduction, Classification of casting processes, Types of patterns, Pattern materials, Pattern allowances, Elements of gating system, Types of gates, Purpose and requirements of riser, Chvorinov's rule, Optimum shape and dimensions of riser, Riser design by Caine's method and Modulus method.

**UNIT - II**

**Moulding and Melting:** Moulding sand and its ingredients, Required properties of moulding sand, Core and core prints, Melting by Cupola furnace, Induction and arc furnace, Casting defects and remedies

**Special Casting Processes:** Pressure die casting, Centrifugal casting, shell moulding, Investment casting and $CO_2$ moulding.

**UNIT- III**

**Arc Welding:** Introduction to welding, Classification of welding processes, DCSP, DCRP, AC, shielded metal arc welding, Submerged arc welding, Gas Tungsten arc welding and gas metal arc welding,

**Resistance Welding:** Principle, Spot, Projection, Seam, Butt and percussion welding processes.

**Solid State Welding:** Friction welding, Ultrasonic welding and explosive welding

**Other Welding Processes**: Oxy-Acetylene welding, Laser beam welding, Electron beam welding, Soldering and brazing.

**UNIT – IV**

**Bulk Deformation Processes:** Open die, Closed die and isothermal forging processes, Rolling

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

process, Nomenclature of rolling , Geometric relationships in rolling, Direct, indirect, hydrostatic and impact extrusion processes , Wire drawing process

**Sheet Metal Operations:** Shearing process, Shearing load, Energy required, Types of shearing processes, Cup drawing process, Calculation of blank diameter for a given cup, Drawing load, Sheet bending process and bend allowance.

**High Energy Rate Forming Processes:** Explosive forming, Electro-hydraulic forming and electromagnetic forming.

**UNIT – V**

**Additive Manufacturing:** Introduction, Stereolithography, Fused deposition modeling, Selective laser sintering and applications of additive manufacturing

**Powder Processing:** Introduction, Production of powders, Mixing, Blending, Compacting and Sintering, Merits, Demerits and application of powder metallurgy products.

**Processing of Plastics, Ceramics and Composites:** Injection moulding, Blow moulding and thermoforming of plastics, Injection moulding and slip casting of ceramics, Roll bending and filament winding of composites.

**Text Books:**

1. G.K. Lal and S.K. Choudhury., Fundamentals of Manufacturing Processes, Alpha science International Ltd., 2005.
2. Mikell P.Grover., Principle of Modern Manufacturing, 5th edition, Wiley , 2014,

**Suggested Reading:**

3. P.N. Rao., Manufacturing Technology, Vol.1, 3rd edition, Tata McGraw Hill Publ., 2011.
4. John Schey., Introduction to Manufacturing Processes, 2nd edition, McGraw Hill Education, 1999
5. Amitabh Ghosh and Mallick., Manufacturing Science, 4th edition, Assoc. East West Press Pvt. Ltd., 2011.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

With effect from the Academic year 2022-23

**20ME C16**

## DYNAMICS OF MACHINES

| | | |
|---|---|---|
| Instruction | 3 | Hours per week |
| Duration of SEE | 3 | Hours |
| SEE | 60 | Marks |
| CIE | 40 | Marks |
| Credits | 3 | |

**Objectives:**

1. To understand force analysis of single slider crank mechanism and turning moment Diagrams for Flywheels
2. To understand the Gyroscopic effect and the performances of Governors
3. To know the Balancing of rotating and reciprocating masses.
4. To determine natural frequencies of undamped, damped and forced vibrating systems of single degree freedom systems.
5. To understand the modes of vibrations, Two degree of Freedom and Torsional Vibrations

**Outcomes:** At the end of the course, the students are able to

1. Apply the concept of dynamically equivalent link and determine the fluctuation of energy for flywheel applications in engines and punching presses.
2. Understand the gyroscopic effects in ships, aero planes and road vehicles.
3. Analyze the characteristics of various centrifugal governors.
4. Analyze balancing problems in rotating and reciprocating machinery.
5. Understand free and forced vibrations of single degree freedom systems and two-degree freedom linear systems.

**UNIT- I**

**Force analysis:** Dynamic force analysis of single slider crank mechanism, concept of dynamically equivalent link and correction couple.

**Flywheels:** Working principle of flywheel, turning moment on the crank shaft, turning moment diagrams, maximum fluctuation of energy and its determination of coefficient of fluctuation of speed. Applications of flywheels in engines and punching presses.

**UNIT- II**

**Gyroscope:** Principle of gyroscope, roll, yaw and pitch motions, gyroscopic effect in a two-wheeler, car, ship and aeroplane.

**Governors:** Necessity of governor, different types of governors, working principle of centrifugal governors, characteristics of Watt, Porter governor, Hartnell governor, controlling force diagram,. Sensitivity, stability and hunting of governor, concept of isochronism of governors. Effort and power of governor.

**UNIT- III**

**Balancing of Rotating masses:** Balancing and its types, rotor balancing, single plane and two plane balancing, unbalanced forces and couples, static and dynamic balancing, balancing of rotors by analytical and graphical methods.

PROFESSOR & HEAD
Department of Mechanical Engineering
...ya Bharathi Institute of Technology (A)
...derabad-500 075, Telangana

**Balancing of reciprocating machines:** Primary and secondary unbalanced forces, balancing of in line and radial engines.

**UNIT - IV**

**Vibrations:** Vibrations of single degree freedom system (axial, transverse and torsional). Natural frequency of equivalent system of combination of springs.

**Damped Vibrations:** Types of damping, vibrations with viscous damping.

**Forced Vibrations:** Vibrations with harmonically applied force with viscous damping, dynamic magnifier, resonance, vibration isolation and transmissibility.

**UNIT –V**

**Two and three degree freedom systems:** Natural frequencies of two degree freedom linear systems. Torsionally equivalent shafts. Whirling speed of shafts. Nodes in two and three rotor systems, modes of vibration.Dunkerley's and Rayleigh's approximate methods. Matrix iteration method, Jacobi's method.

**Text Books:**


1. S.S. Rattan, Theory of Machines, 4th edition ,Tata-Mc Graw Hill, ,2014
2. John.J.Vicker, Gordon R. Pennock, Joseph E. Shigley, Theory of Machines & Mechanisms, Oxford University press, 2003. .
3. William T.Thomson, Theory of Vibration with Application, 5th edition, Pearson education 2008


**Suggested Reading:**


1. A. Ghosh and Mallick, Theory of mechanisms and machines, Affiliated to E-W Press, 1988.
2. J.S. Rao and Gupta, Theory and Practice of Mechanical Vibrations, PHI, 1984


PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

With Effect from the Academic Year 2022 – 23

**20MEE09**

## COMPUTATIONAL FLUID DYNAMICS

(Professional Elective-III)

| | | |
|---|---|---|
| Instruction | 3 | Hours per week |
| Duration of SEE | 3 | Hours |
| SEE | 60 | Marks |
| CIE | 40 | Marks |
| Credits | 3 | |

**Objectives:**

1. To understand governing equations of fluid flow
2. To understand turbulence and how to model them.
3. To know how to discretize governing equations of fluid flow by FDM and their stability.
4. To learn various iterative methods to solve N-S equation.
5. To understand FVM to solve fluid flow equations.

**Outcomes:** At the end of the course, the students are able to

1. Describe and develop mathematical models for flow phenomena.
2. Apply Finite Difference Method for fluid flow and heat transfer problems Classify PDE for fluid flow and heat transfer applications.
3. Use different solvers based on applications
4. Solve fluid flow and heat transfer problems using commercial CFD tools for turbulence models
5. Formulate numerical equations by Finite Volume Method for fluid flow and heat transfer problems

**UNIT-I**

**Governing Equations of Fluid Dynamics and Heat Transfer:**

Introduction to CFD, Models of Flow – Conservation and Non-conservation form - Continuity, Momentum and Energy Equation in conservation and non-conservation form (differential equations only)

**UNIT-II**

**Classifications of Partial Differential Equations**: Elliptic, parabolic and hyperbolic equations, Initial and boundary value problems.

**Discretization and Finite Difference method:** Forward, Backward and Central difference schemes, Transient one and two dimensional conduction - Explicit, implicit, semi-implicit and ADI methods - Stability analysis and error estimation.

**UNIT-III**

**Elliptic Partial Differential Equations:** Jacobi, Gauss Seidel methods, TDMA,

**Viscous incompressible flow,** Vorticity Stream function method.

**UNIT-IV**

**Turbulence Modeling:**

Types of Turbulence modeling-Reynolds and Favre averaged N-S equations, mixing length model, k-epsilon turbulence model.

PROFESSOR & HEAD
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**UNIT-V**

**Finite Volume Method:** Finite volume formulation for diffusion equation, convection diffusion equation, Solution algorithm for pressure velocity coupling in steady flows, staggered grid, SIMPLE algorithm.

**Text Books:**

1. P.S. Ghoshdastidar, Computational Fluid Dynamics & Heat Transfer, Cengage Pub., 2018.
2. J.D. Anderson, Jr., Computational Fluid Dynamics: The Basic with Applications, McGraw Hill, Inc., 2012.
3. H. Versteeg and W. Malalasekra, An Introduction to Computational Fluid Dynamics : The Finite Volume Method, 3rd edition, Pearson, , 2016

**Suggested Reading:**

1. F. John Wendt (Editor), Computational Fluid Dynamics - An Introduction‖, Springer – Verlag, Berlin, 1992.
2. Charles Hirsch, Numerical Computation of Internal and External Flows‖, Vols. I and II. John Wiley & Sons, New York, 1988.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

CBIT (A) With Effect from the Academic Year 2021-22

**20MEE02**

**PRODUCTION AND OPERATIONS MANAGEMENT**

(Professional Elective-I)

| | |
|---|---|
| Instruction | 3 L Hours per Week |
| Duration of SEE | 3 Hours |
| SEE | 60 Marks |
| CIE | 40 Marks |
| Credits | 3 |

**Objectives:**

1. Understand plant layout design to facilitate material flow and processing of a product in the most efficient manner
2. 2. Gain some ability to recognize situations in a production system environment that suggests the use of certain quantitative methods to assist in decision making on operations management and strategy.
3. Understand how Materials Requirement Planning and MRPII systems are used in managing operations
4. Recognize the importance of Inventory control to ensure their availability with minimum capital lock up.
5. Evaluate the quality processes in manufacturing and service sector to improve the operational performance

**Outcomes:** At the end of the course, the students are able to

1. Understand the role of production system and its design in production and operations management.
2. Apply forecasting techniques for predicting demand
3. Use aggregate planning, master scheduling and materials requirement planning in a production system
4. Compare various inventory control techniques used in production system.
5. Apply the quality control tools to improve performance of production system.

**UNIT-I**

**Introduction:** Production systems, Classification and characterisation

**Plant Location and Layout:** Factors affecting plant location, Objectives of plant layout, Types of layouts, Merits and demerits.

**Work Study:** Productivity, Introduction to method study and work measurement, Standard time calculations, Work sampling.

**UNIT-II**

**Forecasting:** Introduction, Forecasting objectives and uses, Demand patterns, Qualitative models, Market survey, Delphi method, Quantitative models, Moving average, Weighted

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

moving average, Simple exponential smoothing, Trend adjusted exponential smoothing, Simple regression.

**Forecast Errors:** Mean absolute deviation, Mean square error, Mean forecast error, Mean absolute percentage error

**UNIT-III**

**Aggregate Planning and Master Scheduling:** Introduction, Objectives of aggregate planning, Cost in aggregate planning, Strategies in aggregate planning, Master production scheduling.

**Materials Requirement Planning:** Importance, MRP system, Inputs and outputs, Bill of materials.

**UNIT-IV**

**Inventory Control:** Importance, Inventory control systems, Types of Inventories, Inventory costs, Deterministic Inventory models, Basic purchase model, Purchase model with instantaneous replenishment and with shortages, Basic production model, Production model with shortages, Inventory model with price breaks, Just-in-time system eévolution and its characteristics.

**UNIT-V**

**Quality Control:** Introduction, Quality gurus and their contributions, Quality tools, Process capability, Quality control by control charts, Sampling plans, Operating characteristic curve, Introduction to total quality management and six-sigma.

**Text Books:**

1. Joseph G. Monks., Operations Management: Theory and Problems, 3rd edition, McGraw Hill International Edition, 1987.
2. William J. Stevenson., Operations Management, 8th edition, Tata McGraw Hill Edition, 2005.

**Suggested Reading:**

1. Everrete E. Adam and Ronald J. Ebert., Production & Operations Management, 5th edition, Prentice Hall of India, 2005.
2. R. Panneerselvam., Production and Operations Management, 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2006.
3. Elwood S. Buffa., Modern Production/Operations Management, 5th edition, John Wiley Publishers, Singapore, 2002

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

With Effect from the Academic Year 2022–23

**22MEC38**

## DIGITAL FABRICATION LAB

| | |
|---|---|
| Instruction | 3P Hours per week |
| Duration of SEE | 3 Hours |
| SEE | 50 Marks |
| CIE | 50 Marks |
| Credits | 1.5 |

**Objectives**: The objectives of this course are to:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive &team work attitude to get things right the first time.
3. Provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. Advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

**Outcomes**: After completion of course, students would be able to:

1. Understand safety measures to be followed in workshop to avoid accidents.
2. Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes.
3. Make a given model by using workshop trades including fitting, carpentry, tinsmithy and House
   wiring.
4. Perform various operations in welding, machining and casting processes.
5. Conceptualize and produce simple device/mechanism of their choice.

**List of exercises:**
**Group-1**

1. To make a lap joint on the given wooden piece according to the given dimensions.
2. To make a dove tail-joint on the given wooden piece according to the given dimensions.
3. a)Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch
   b) Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three pin socket
4. Stair case wiring-wiring of one light point controlled from two different places independently using two 2- way switches.
5. To make external threads for GI pipes using die and connect the GI pipes as per the given diagram using taps, couplings & bends.
6. To connect the GI pipes as per the given diagram using, couplings, unions, reducer & bends.
   To connect the GI pipes as per the given diagram using shower, tap & valves and Demonstrate by giving water connection

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Department of Mechanical Engineering
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Gandipet, Hyderabad-500 075, Telangana

**Group- 2**

1. To Study the method of Additive Manufacturing process using a 3D printer
2. To create a 3D CAD model of a door bracket using a modeling software
3. To Print a door bracket using an extruder type 3D Printer.
4. To create a 3D CAD model by reverse Engineering
5. To Design an innovative component using the CAD software
6. To Print the selected innovative component by the students using a 3D printer

**Text Books:**

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., Elements of Workshop Technology, Vol. I, 2008 and Vol. II, Media promoters and publishers private limited, Mumbai, 2010.
2. Kalpakjian S. And Steven S. Schmid, Manufacturing Engineering and Technology, 4th edition, Pearson Education India Edition, 2002.
3. Sachidanand Jha , 3D PRINTING PROJECTS: 200 3D Practice Drawings For 3D Printing On Your 3D Printer , June 7, 2019.

**Suggested Reading:**

1. Gowri P. Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
2. Oliver Bothmann , 3D Printers: A Beginner's Guide , January 1, 2015

# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

**Scheme of Instructions of I Semester of B.E. – Mechanical Engineering as per AICTE Model Curriculum 2022-23**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**SEMESTER – I**

| S. No | Course Code | Title of the Course | Scheme of Instruction | | | Credits |
|---|---|---|---|---|---|---|
| | | | Hours per Week | | | |
| | | | L | T | P/D | |
| **THEORY** | | | | | | |
| 1 | 22MTC02 | Calculus | 3 | 1 | 0 | 4 |
| 2 | 22CYC01 | Chemistry | 3 | 0 | 0 | 3 |
| 3 | 22EEC01 | Basic Electrical Engineering | 2 | 1 | 0 | 3 |
| 4 | 22CSC01 | Problem Solving and Programming | 2 | 1 | 0 | 3 |
| **PRACTICAL** | | | | | | |
| 5 | 22CYC02 | Chemistry Lab | 0 | 0 | 3 | 1.5 |
| 6 | 22MBC02 | Community Engagement | 0 | 0 | 3 | 1.5 |
| 7 | 22CSC02 | Problem Solving and Programming Lab | 0 | 0 | 3 | 1.5 |
| 8 | 22MEC37 | Robotics & Drones Lab | 0 | 2 | 2 | 3 |
| 9 | 22EEC02 | Basic Electrical Engineering Lab | 0 | 0 | 2 | 1 |
| **TOTAL** | | | **10** | **5** | **13** | **21.5** |

**L: Lecture** **T: Tutorial** **D: Drawing** **P: Practical**

**CIE - Continuous Internal Evaluation** **SEE - Semester End Examination**

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

With effect from the Academic Year 2022–23

**22MEC37**

## ROBOTICS AND DRONES LAB

(Common to All Branches)

| | |
|---|---|
| Instruction | 2T + 2P Hours per week |
| CIE | 100 |
| Credits | 3 |

**Objectives**: The objectives of this course are to:

1. To develop the students' knowledge in various robot and drone structures and their workspace.
2. To develop multidisciplinary robotics that have practical importance by participating in robotics competitions
3. To develop students' skills in performing spatial transformations associated with rigid body motions, kinematic and dynamitic analysis of robot systems.
4. Through projects done in lab, increase the true hands-on student learning experience and enhance their conceptual understanding, increase students' ability, competence and teamwork skills on dealing with real-life engineering problems

**Outcomes**: After completion of course, students would be able to:

1. Demonstrate knowledge of the relationship between mechanical structures of robotics and their operational workspace characteristics
2. Understand mechanical components, motors, sensors and electronic circuits of robots and build robots.
3. Demonstrate knowledge of robot controllers.
4. Use Linux environment for robotic programming.
5. Write Python scripts to control robots using Python and Open CV.

**Lab Experiments:**

1. Assembling of robot mechanical components, mounting of motors, sensors, electronic circuits to the chassis.
2. Connecting to electronic circuitry: motor drivers, incremental encoders proximity sensors, micro controller,
3. Different types of batteries, selection of suitable battery for application, safety precaution.
4. Introduction to Linux Command Line Interface: basic file and directory management and other useful commands
5. Controlling robot using Python: i) Move robot using Python code, ii) Make robot move in patterns using Python
6. Robot programming with Sensor inputs:i) Read sensor data using Python, ii) Visualize sensor data using Python, iii) Code robot to avoid obstacles by using sensor data
7. Open CV: i) Create an Image and display an image; ii) Read and change pixel values; iii) Create colored shapes and save image; iv) Extract the RGB values of a pixel; v) Reading and Writing Videos
8. Open CV: i) Extraction of Regions of Interest; ii) Extraction of RGB values of a pixel
9. Coding robot to work with colors, follow colored objects, identifying shape of the object-oriented
10. Projects: i)Making a line follower robot using a Camera; ii) Writing code for a complex function
11. Assembly of a drone

**Suggested readings**


1. https://www.geeksforgeeks.org/robotics-introduction/
2. https://www.ohio.edu/mechanical-faculty/williams/html/PDF/IntroRob.pdf
3. https://www.idtechex.com/en/research-report/new-robotics-and-drones-2018-2038-technologies-forecasts-players/584
4. https://dronebotworkshop.com/


PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

## Scheme of Instructions of II Semester of B.E. – Mechanical Engineering as per AICTE Model Curriculum 2020-21

## DEPARTMENT OF MECHANICAL ENGINEERING

**SEMESTER -II**

| S. No | Course Code | Title of the Course | Scheme of Instruction | | | Scheme of Examination | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Hours per Week | | | Duration of SEE in Hours | Maximum Marks | | |
| | | | L | T | P/D | | CIE | SEE | |
| **THEORY** | | | | | | | | | |
| 1 | 20MT C06 | Vector Calculus and Differential Equations | 3 | 1 | - | 3 | 40 | 60 | 4 |
| 2 | 20EG C01 | English | 2 | - | - | 3 | 40 | 60 | 2 |
| 3 | 20PY C05 | Mechanics and Materials Science | 3 | - | - | 3 | 40 | 60 | 3 |
| 4 | 20EEC01 | Basic Electrical Engineering | 3 | - | - | 3 | 40 | 60 | 3 |
| **PRACTICAL** | | | | | | | | | |
| 5 | 20EG C02 | English lab | - | - | 2 | 3 | 50 | 50 | 1 |
| 6 | 20PY C08 | Mechanics and Materials Science Lab | - | - | 4 | 3 | 50 | 50 | 2 |
| 7 | 20EEC02 | Basic Electrical Engineering Lab | - | - | 2 | 3 | 50 | 50 | 1 |
| 8 | 20ME C01 | CAD and Drafting | - | 1 | 3 | 3 | 50 | 50 | 2.5 |
| 9 | 20MB C02 | Community Engagement | 30 field + 2P/W | | | - | 50 | - | 1.5 |
| **TOTAL** | | | **11** | **2** | **11** | **-** | **410** | **440** | **20** |

**L: Lecture** **T: Tutorial** **P: Practical**

**CIE - Continuous Internal Evaluation** **SEE - Semester End Examination**

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Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

With Effect from the Academic Year 2023–24

**20MEE17**

## RENEWABLE ENERGY SOURCES

(Professional Elective-V)

| | | |
|---|---|---|
| Instruction | 3 | Hours per week |
| Duration of SEE | 3 | Hours |
| SEE | 60 | Marks |
| CIE | 40 | Marks |
| Credits | 3 | |

**Objectives:**

1. Need and importance of non-conventional energy resources
2. Extent of solar energy which can be utilized as energy resource
3. Concept of wind energy and its merits and demerits
4. Operating principles of geothermal energy and bio-energy
5. Merits and demerits of tidal energy, wave energy and OTEC

**Outcomes**: At the end of the course, the students will be able to

1. Recognise the importance of renewable energy and solar geometry.
2. Select the solar collector based on the application.
3. Understand the working principles of wind power plants.
4. Understand the principles of geothermal and biogas plants.
5. Distinguish wave, tidal and OTEC energy.

**UNIT-I**

**Energy Sources**: forms of energy, energy chain (route), Indian energy scenario, energy and environment, energy conservation and its importance, , classification of energy sources, classification of Renewable energy sources(RES), advantages and limitations of non renewable and renewable energy sources.

**Solar Energy**: Solar radiation, basic definitions: Irradiance, solar constant, insolation, radiosity, latitude, hour angle, declination, altitude angle, zenith angle, azimuth angle and radiation measuring instruments

**UNIT-II**

**Solar thermal collectors**: working, comparison, merits and demerits of flat plate and concentrating (focusing) collectors.

**Applications of solar collectors:** water heating, space heating, solar cookers, solar pond, solar thermal power plants based on central receiver, dish/stirling cycle and chimney, solar refrigeration.

**Solar photovoltaics**: materials, cells, space based solar power (SBSP), advantages and disadvantages. PV System applications stand alone and grid connected systems, various components of solar powered systems.

**UNIT-III**

**Wind Energy**: Sources of wind, merits and demerits of wind energy, site selection factors, classification of wind mills(turbines), working and comparison of horizontal axis, Savonius and Darries vertical axis windmills, power extracted from the wind, power duration and velocity duration characteristic curves, wind-solar and wind-diesel hybrid plants

**UNIT-IV**

**Geothermal Energy**: Layers in earth, resources of geothermal energy, hydrothermal, petrothermal and geopressure resources, advantages, disadvantages, applications and environmental effects of geothermal energy sources.

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Chaitanya Bharathi Institute of Technology (
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**Biomass Energy**: Resources, site selection factors, bio mass conversion processes: direct combustion, thermo chemical, bio chemical, working of KVIC, Janata, Deenbandu and Pragathi design(spherical) biogas plants, operational problems, causes and remedies relating to a biogas plant.

**UNIT V**

**Tidal power**: Tidal systems, site selection for tidal power plant, operation of single basin and double basin tidal plants, advantages and disadvantages of tidal power.

**Wave energy** - Differences between tides and waves, advantages and disadvantages of wave power, working principle of wave energy conversion devices.

**Ocean thermal energy conversion (OTEC)**: OTEC power plants, location, open cycle and closed cycle OTEC plants, advantages, limitations and applications of OTEC, environmental impact of OTEC plants.

**Text Books:**

1. S. Hasan Sayeed and D.K. Sharma, Non Conventional Energy Resources, S.K. Kataria & Sons, New Delhi, 2017.
2. Dr. R.K. Singal, Non Conventional Energy Resources, S.K. Kataria & Sons, New Delhi, 2005.
3. G.D. Rai, Non Conventional Energy Sources, Khanna Publishers, New Delhi, 2011.

**Suggested Reading:**

1. K. M. Mittal, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, New Delhi, 2003.
2. R.K.Rajput, Non-Conventional Energy Sources and utilisation, S.Chand,2016.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

With Effect from the Academic Year 2022 – 23

**20MEC25**

## THERMAL TURBO MACHINES

| | | |
|---|---|---|
| Instruction | 3 | Hours per week |
| Duration of SEE | 3 | Hours |
| SEE | 60 | Marks |
| CIE | 40 | Marks |
| Credits | 3 | |

**Objectives:**

1. To acquire basic knowledge of functioning of nozzles and diffusers.
2. To understand the design of ducts with frictional flow.
3. To know the working principles of various rotary compressors.
4. To understand the working of steam turbines.
5. To acquire basic knowledge in the functioning of gas turbines.

**Outcomes:** At the end of the course, the students will be able to

1. Design various configurations of nozzles and diffusers with the principles of Gas Dynamics.
2. Design the ducts for friction with the principles of Fanno Flow.
3. Estimate the power required for various types of rotary compressors
4. Determine the various efficiencies related to Steam Turbines.
5. Determine the power output of the Gas Turbine and understand the working principle of jet and rocket propulsion.

**UNIT-I**

**Introduction to Compressible Flows:** Speed of propagation of pressure waves, Mach number, Acoustic velocity and Mach cone, compressibility factor for compressible and incompressible flows, pressure field due to a moving source of disturbance, one dimensional compressible flow. Isentropic flow with variable area, Static and Stagnation properties, Mach number variation, Area ratio as function of Mach number, flow through different types of nozzles and diffusers Flow with Normal Shocks, governing equations.

**UNIT-II**

**Flow in Constant Area Ducts with Friction-Fanno Flow:** Variation of flow properties, variation of Mach number with duct length, isothermal flow with friction, Prandtl – Meyer relation, Rankine-Hugoniot equations and Stagnation pressure ratio across shock.

**UNIT-III**

**Rotodynamic Compressors**: Introduction to Turbomachines, classification and applications. Comparison of Reciprocating and Rotary compressors, Positive displacement Rotary compressors, Flow through rotary compressors. Static and total head quantities Thermodynamic cycles and work done, calculation of various efficiencies, Velocity diagrams and prewhirl, Euler equation for energy transfer between fluid and rotor, Degree of reaction of rotary compressors, Chocking, Surging and Stalling.

**UNIT-IV**

**Steam Turbines**: Study of Steam nozzles; Classification of steam turbines, Impulse turbine, compounding of steam turbines, Pressure velocity variations across different compounding turbines, blade efficiency and work done by impulse turbine, degree of reaction of reaction turbine, blade efficiency and work done by reaction turbine, stage efficiency and nozzle efficiency and simple problems on impulse and reaction turbines, Governing of Turbines.

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Department of Mechanical Engineering
Vaagdevi Institute of Technology (A)
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**UNIT-V**

**Gas Turbines**: Applications and classification of Gas Turbines- constant pressure and constant volume gas turbines, Joule cycle-configuration diagram and temp-entropy diagram, Thermal efficiency of Joules cycle, maximum pressure ratio in terms of temperature ratio, optimum pressure ratio for maximum work output with and without considering machine efficiencies, Improvement of gas turbine plant performance- Inter-cooling, Reheating and Regeneration. Simple problems on Joule cycle.

**Air Craft Propulsion**: Air craft engine types, air craft propulsion theory, Turbo jet engines, simple problems, Ramjet engines, Pulse jet engines.

**Rocket Propulsion:** Types of Propellants, types of Rocket engines, Rocket propulsion theory and its applications.

**Text Books:**

1. S M Yahya, Fundamentals of Compressible Flow, New Age International Publishers, 2014.
2. Mahesh M. Rathore, Thermal Engineering, TMH, New Delhi, 2010
3. M L Mathur & F S Mehta, Thermal Engineering, Jain Brothers, New Delhi, 2014

**Suggested Reading:**

1. V. Ganeshan, Gas Turbines, Tata Mc Graw Hills, New Delhi, 2010.
2. R Yadav, Steam and Gas Turbines, Central Publishing House Ltd, Allahabad, 2003.

With Effect from the Academic Year 2022 – 23

**20MEC30**

## THERMAL ENGINEERING LAB

| | | |
|---|---|---|
| Instruction | 2 | Hours per week |
| Duration of SEE | 3 | Hours |
| SEE | 50 | Marks |
| CIE | 50 | Marks |
| Credits | 1 | |

**Objectives:**

1. To demonstrate knowledge in evaluating thermal conductivity of a metal rod and critical heat flux of a material.
2. To know about the phase change heat transfer and performance of cross flow heat exchanger.
3. To understand the working of principle of axial flow fan and centrifugal blower.
4. To evaluate the COP of Refrigeration tutor and AC tutor.
5. To determine the pressure distribution in nozzle; drag and lift coefficients for contoured bodies.

**Outcomes:** At the end of the course, the students will be able to

1. Determine thermal conductivity of a metal rod and critical heat flux of a copper wire.
2. Estimate the convective heat transfer coefficients for phase change heat transfer and effectiveness of cross flow heat exchanger.
3. Determine the overall efficiency of centrifugal/axial-flow compressor.
4. Study of COP of refrigeration/air conditioning tutor.
5. Determine the - pressure distribution in a nozzle/cylinder/aero-foil; lift and drag forces for different geometrical profiles.

**List of the Experiments**

1. Study of Thermal conductivity of metal rod.
2. Determination of critical heat flux for copper wire in water.
3. Evaluate the convective heat transfer coefficient of dropwise and filmwise condensation.
4. Evaluate the effectiveness of cross flow heat exchanger.
5. Determination of overall efficiency of centrifugal blower
6. Study of overall efficiency of axial flow fan
7. Study of COP of refrigerating tutor
8. Study of COP of air conditioning tutor
9. Determination of pressure distribution for convergent and divergent nozzle
10. Determination of pressure distribution for a cylinder
11. Determination of pressure distribution for an aerofoil.
12. Determination of lift and drag coefficient for different contours
13. Determination of Sensible and Latent heat loads for a class room and validating the data with RAC software.

**Note: Student should complete a minimum of 10 experiments including experiment number 13 which iscompulsory.**

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

**Text Books:**

1. S M Yahya, Fundamentals of Compressible Flow, New Age International Publishers, 2014.
2. Mahesh M. Rathore, Thermal Engineering, TMH, New Delhi, 2010
3. M L Mathur & F S Mehta, Thermal Engineering, Jain Brothers, New Delhi, 2014

**Suggested Reading:**

1. V. Ganeshan, Gas Turbines, Tata Mc Graw Hills, New Delhi, 2010.
2. R.K. Rajput, Heat Transfer, Laxmi Publication, 2014

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

With Effect from the Academic Year 2023–24

**20MEE18**

## DIGITAL MANUFACTURING AND INDUSTRY 4.0

(Professional Elective-V)

| | | |
|---|---|---|
| Instruction | 3 | Hours per week |
| Duration of SEE | 3 | Hours |
| SEE | 60 | Marks |
| CIE | 40 | Marks |
| Credits | 3 | |

**Objectives:**

1. Understand the concept and applications of Digital Manufacturing and Industry 4.0.
2. Relate different Additive manufacturing processes as a part of Digital Manufacturing
3. Understand the concept of Virtual prototyping, digital design and Importance of reverse engineering in Digital Manufacturing
4. To understand the concept of Industry 4.0 and allied technologies.
5. To Provide an understanding on the challenges faced and relevant industrial applications of Industry 4.0

**Outcomes:** At the end of the course, the students will be able to:

1. Understand the Basics and applications of Digital Manufacturing and Industry 4.0.
2. Understand the role of Additive Manufacturing, Virtual prototyping and Reverse Engineering processes and their adaptability to Digital Manufacturing.
3. Understand the concepts of digital manufacturing based product life cycle and its management.
4. Understand the concept of Industry 4.0 and allied technologies.
5. Understand the basics of Internet of things and cloud computing pertaining the fourth industrial revolution.

**UNIT-I**

**Introduction to digital manufacturing**: Definition of digital manufacturing, Operation Mode and Architecture of Digital Manufacturing System, Impact on manufacturing careers, Advantages of digital manufacturing and design, Information sharing in the digital thread, Digital twins and Files format (STL, AMF, 3MF), Multiple organizations in the manufacturing process. Introduction of Industry 4.0, case study on car manufacturing by Bosch.

**UNIT-II**

**Additive Manufacturing Processes:** Additive Manufacturing processes – Engineering polymers, metals and ceramics. Stereolithography, Selective Laser Sintering, Fused Deposition Modeling, Layered object manufacturing. Electronic Materials, Bio-printing, Food Printing. Preprocessing and Post processing in AM

**Virtual Prototyping & Reverse Engineering:** Virtual Prototyping, Applications, Virtual Prototyping and Virtual Manufacturing. Reverse Engineering, Application of Reverse Engineering in Digital Manufacturing. Self-Learning of Manufacturing System and Intelligent Manufacturing System.

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Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

**UNIT-III:**

**Key Technology of Digital Manufacturing**: Various Digital Technologies in Product Lifecycle, Digital Equipment and Digital Processing Technology, Technology of Digital Maintenance and Diagnosis.

**Product life cycle management:** Introduction, Types of Product Data, Product life cycle management (PLM) systems. Features of PLM System, System architecture, Product information models, Functionality of the PLM Systems.

**UNIT-IV:**

**Industry 4.0**: Various Industrial Revolutions, Compelling Forces and Challenges for Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory, automation, data exchanges, cloud, cyber-physical systems, mobile robots, Big Data, deep machine learning, Production Systems, IoT, Challenges of implementing Industry 4.0, Impact of implementing Industry 4.0 in various sectors, Applications domains and the way forward.

**UNIT –V:**

**Internet of Things (IoT)** - IoT design methods, physical devices and enabling technologies, Industrial Internet of Things (IIoT), Smart Manufacturing.

**Cloud Computing and Manufacturing**- Cloud models, cloud manufacturing examples, cloud based manufacturing, Cloud service and platforms for manufacturing.

Augmented Reality and Virtual Reality in Manufacturing.

**Text Books:**


1 Zude Zhou, Shane (Shengquan) Xie and Dejun Chen, Fundamentals of Digital Manufacturing Science, Springer-Verlag London Limited,2012

2 Brent Stucker, David Rosen, and Ian Gibson, Additive Manufacturing Technologies, ISBN 978-1-4419-1120-9, Springer, 2010

3 Chee Kai Chua, Kah Fai Leong, 3D printing and additive manufacturing: principles and Application, 4th edition of rapid prototyping

4 Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things.


**Suggested reading:**


1 Lihui Wang and Andrew Yeh Ching Nee, Collaborative Design and Planning for Digital Manufacturing, Springer-Verlag London Limited, 2009

2 Venuvinod, PK; Ma, W; Rapid prototyping – Laser based and other technologies, Kluwer,2004


PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

**20ME C205**

## ADVANCED HEAT AND MASS TRANSFER

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of SEE | 3 Hours |
| SEE | 60 Marks |
| CIE | 40 Marks |
| Credits | 3 |

**Objectives:** To make the students to

1. Understand the basic principles of fins and unsteady state heat transfer applied to industries.
2. Learn various equations and their application in engineering heat transfer
3. Understand boundary layer concept and their applications
4. Learn about principles of phase heat transfer and radiation heat transfer
5. Learn about mass transfer and its applications in process industries

**Outcomes:** At the end of the course, Student will be able to

1. Apply the equations pertaining to unsteady state heat transfer and knowledge in extended surfaces
2. Evaluate mass, momentum and energy equations with approximate and exact methods
3. Apply heat transfer knowledge in calculation of boundary layer thickness and various dimensionless numbers
4. Evaluate heat transfer coefficients under phase change phenomena and radiation heat transfer
5. Apply the knowledge of mass transfer in process industries

**UNIT - I**

**Brief Introduction to Different Modes of Heat Transfer**: Conduction: General heat conduction equation-Initial and Boundary conditions Steady State Heat Transfer: Simplified heat transfer in 1D and 2D – Fins. Transient heat conduction; Lumped system analysis- Heisler charts-semi infinite solid-use of shape factors in conduction - 2D transient heat conduction – product solutions

**UNIT - II**

**Finite Difference Methods for Conduction**: 1D & 2D steady state and simple transient heat conduction problems – implicit and explicit methods. Forced Convection: Equations of Fluid Flow – Concepts of Continuity, momentum

equations – Derivation of Energy equation - Methods to determine heat transfer coefficient: Analytical Methods - Dimensional Analysis and concept of exact solution.Approximate Method – Integral analysis

**UNIT- III**

**External Flows**: Flow over a flat plate: Integral method for laminar heat transfer coefficient for different velocity and temperature profiles. Application of empirical relations to variation geometrics for Laminar and Turbulent flows. Internal flows: Fully developed flow: Integral analysis for laminar heat transfer coefficient – Types of flow – Constant Wall Temperature and Constant Heat Flux Boundary Conditions - Hydrodynamic & thermal entry lengths; use of empirical correlations

**UNIT - IV**

**Free Convection & Radiation**: Approximate analysis on laminar free convective heat transfer – Boussinesque Approximation - Different geometries – combined free and forced convection, Boiling and condensation: Boiling curve – Correlations- Nusselt's theory of film condensation on a vertical plate – Assumptions & correlations of film condensation for different geometrics

**UNIT - V**

**Mass Transfer**: Radiation Heat Transfer, Radiant heat exchange in grey,non-greybodies, withtransmitting, reflectingandabsorbingmedia, specularsurfaces, gas radiation – radiation from flames. Mass Transfer: Concepts of mass transfer – Diffusion & convective mass transfer Analogies – Significance of non-dimensional numbers.

**Text Books:**

1. Necati Ozisik, "Heat Transfer", TMH, 1998.
2. Incropera Dewitt, "Fundamentals of Heat & Mass Transfer", John Wiley,2007.
3. Yunus A. Cengel, "Heat Transfer: A basic approach", TMH, 2008.

**Suggested Reading:**

1. R. C. Sachdeva, "Fundamentals of Engineering Heat & Mass Transfer", New Age International Publications, 2010.
2. J.P. Holman, "Heat Transfer", Mc Graw Hill, 2008.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

**20ME E209**

## TURBO MACHINES

(Programme Elective – IV)

| | |
|---|---|
| Instruction | 3 Hours per week |
| Duration of SEE | 3 Hours |
| SEE | 60 Marks |
| CIE | 40 Marks |
| Credits | 3 |

**Objectives:** Student will understand

1. Principles and equations of turbo machinery
2. Velocity triangle and power developed by steam turbines
3. Working principles of Pelton, Francis and Kaplan turbines
4. Working principles of axial flow compressor and centrifugal compressor and their performance
5. Power required for rotary compressors and power developed bygas turbines

**Outcomes:** At the end of the course, student will be able to

1. Apply gas dynamics equations depending upon applications
2. Estimate the power developed by steam turbines
3. Calculate hydraulic efficiency of impulse and reaction turbines
4. Find the efficiency, pressure rise, degree of reaction, slip factor and performance of axial flow and centrifugal compressors
5. Understand cycles and improve the cycle efficiency in gas turbines

**UNIT - I**

**Fundamentals of Turbo Machines:** Classifications, Applications, Isentropic flow, Energy transfer, Efficiencies, Static and Stagnation conditions, Fluid equations - continuity, Euler's, Bernoulli's equation and its applications. Euler's flow through variable cross sectional areas.

**UNIT - II**

**Steam Turbines:** Convergent and Convergent-Divergent nozzles, Energy Balance, Effect of back pressure, Design of nozzles. Steam Turbines: Impulse turbines, Work done and Velocity triangle, Efficiencies, Compounding

**UNIT- III**

**Hydraulic Turbines:** Introduction, Classification of turbines, Impulse and reaction turbines, construction, working and performance of Pelton, Francis and Kaplan Turbines, Selection of turbines: specific speed, unit quantities.

PROFESSOR & HEAD
Dept. of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

**UNIT - IV**

**Axial Flow Compressors and Centrifugal Compressors:** Work and velocity triangles, Efficiencies, Stage pressure rise, Degree of reaction, Performance of compressors, Velocity triangles and efficiencies; slip factor, performance of compressors.

**UNIT - V**

**Gas Turbines:** Principle of working – Classification – Joule's cycle – work done and efficiency – Brayton Cycle – Optimum Pressure ratio for maximum power and maximum efficiency – $P_{max}$ and $\eta_{max}$ – Improvement in cycle performance – Intercooling, Reheating and Regeneration (Heat exchanging) – Problems using these principles.

**Text Books:**

1. S. M. Yahya, "Turbines, Compreessors and Fans", 4/e, Tata McGraw-Hill Education Pvt. Ltd., 2010.
2. G.Gopalakishnan and D. Prithvi Raj, "Atreatise on Turbomachines", Scitec Publications, Chennai, 2002.
3. Seppo. A. Korpela, "Principles of Turbomachinery", John Wiley & sons Inc. Publications, 2011.

**Suggested Reading:**

1. R. K. Turton, "Principles of Turbomachinery", E & F N Spon Publishers, London & New York,2004.
2. Dennis G. Shepherd, "Principles of Turbomachines", Macmillan, 2007.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

## DEPARTMENT OF MECHANICAL ENGINEERING

## Action taken report on Alumni, Recruiters and Industry feedback

## 2021-22

| S. No | Description | Action Taken/Proposed | Page No |
|---|---|---|---|
| 1 | Maximum respondents rated performance POs & PSOs as good | | – |
| 2 | Mr. Pranay kumar, suggested to introduce composites & polymers in curriculum and also suggested to introduce advanced manufacturing systems in the curriculum | "Plastics, ceramics & composite materials" course was introduced in curriculum. Courses namely additive manufacturing, digital manufacturing & industry 4.0, manufacturing systems simulation, micro manufacturing, nano materials science & Technology are introduced as electives in curriculum. | 38-42 |
| 3 | Mr. Aditya asked to introduce probability and statistics | Same was communicated to Department of Mathematics and the topics were introduced subsequently. | 43-44 |
| 4 | Ms Shiva Leela felt that the following the important courses are strength of materials, Manufacuturing Process, Dynamics of Machines, C, C++ and Java | The courses namely strength of materials, Manufacturing Process, Dynamics of Machines and C, C++ are existing in the curriculam she studied i.e R16. Java is being offered as open elective from R-18 onwrds. | 45-50 |
| 5 | Mr. Abhay Edlabadkar, suggest the more software development or technology exposure. Newer technologies such as Laser Additive Manufacturing, Bio Tech/Sciences Manufacturing, Semiconductor and Electronics (advanced) manufacturing technologies (Clean room fabs), Optics manufacturing and using of lasers. The equipment, manufacturing processes, electronic control theory, environment control, precision requirements are different from standard machine tools. Every year starting with end of year 1 summer, strong push and emphasis on hands on internship. This way by the time the student graduates, they have exposure to 3-4 different companies, products, technologies, and exposure to different company cultures and teams. In present day, there is no "pure" engineering as most activities and projects will require exposure to varying engineering subjects and fields. During his time he spent 3 years at CITD and ECIL, which helped him get the exposure and experience required to succeed including working at Bell Labs. | Internships are made mandatory during I,II and III semester breaks. Robotics and Drones lab, Digital fabrication lab are introduced to teach multi disciplinary topics the students. Control systems. System Automation and control are is introduced to have exposure to the field of electronics | 49, 51, 53-56 |

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Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
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| S. No | Description | Action Taken/Proposed | Page No |
|---|---|---|---|
| 6 | CVL Prasad, General Manager (D), ONGC, Rajahmundry suggested that the project work/internships should be at least 6 weeks duration so that they should know the job requirement & competent enough so do the job. Skills like communicating and understanding the job requirement is essential. | Semester long internships are permitted in VII & VIII sem subjected to certain conditions. | 57 |
| 7 | Mr. Venkatesh Yerramalla, suggested more practical exposure and critical thinking need to be developed at the time of learning engineering – which primarily is not addressed.<br>He felt the manner of teaching should change – it should be more oriented towards problem solving and build creative thinking along with strong fundamentals of respective engineering domain. | The same is being done by giving more weigtage to the assignments at higher BTL and by introducing Idea lab etc. | – |

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

PROFESSOR & HEAD
Department of Mechani Engineering
Chaitanya Bharathi Instit hnology (A)
Gandipet, Hyderabad- elangana

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**CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)**

Scheme of Instruction as per R20 Curriculum

**B.E. (MECHANICAL ENGINEERING)**

**SEMESTER – VII**

| S. No. | Course Code | Title of the Course | Scheme of instruction | | | Scheme of Examination | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Hours per week | | | Duration in Hours | Maximum Marks | | |
| | | | L | T | P/D | | CIE | SEE | |
| **THEORY** | | | | | | | | | |
| 1 | | Professional Elective - IV | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 2 | | Professional Elective - V | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 3 | | Open Elective - II | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 4 | | Open Elective – III | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 5 | 20EGM04 | Gender Sensitization | 2 | -- | -- | 2 | -- | 50 | *Non Credit |
| 6 | 20MBC01 | Engineering Economics and Accountancy | 3 | -- | -- | 3 | 40 | 60 | 3 |
| **PRACTICALS** | | | | | | | | | |
| 7 | 20MEC33 | Project Part-1 | -- | -- | 4 | -- | 50 | -- | 2 |
| | | Internship | 4-6 Weeks/ 180 hours | | | | | | 3 |
| **TOTAL** | | | **17** | **--** | **04** | **--** | **250** | **350** | **17+3** |

*L: Lecture* *T: Tutorial* *D: Drawing* *P: Practical*

**CIE - Continuous Internal Evaluation** **SEE – Semester End Examination**

| **Professional Elective – IV (3/3)** | | | **Professional Elective – V (3/3)** | | |
|---|---|---|---|---|---|
| S.No. | **Subject Code** | **Name of the Subject** | **S. No.** | **Subject Code** | **Name of the Subject** |
| 1 | 20MEE13 | Automobile Engineering | 1 | 20ME E17 | Renewable Energy Sources |
| 2 | 20MEE14 | Control System Theory | 2 | 20ME E18 | Digital Manufacturing and Industry 4.0 |
| 3 | 20MEE15 | Mechanical Vibrations | 3 | 20ME E19 | Composite Materials and Testing |
| 4 | 20MEE16 | Supply Chain Management | 4 | 20ME E20 | Block Chain Technology |

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**20MEC06**

## MANUFACTURING PROCESSES

| | |
|---|---|
| Instruction | 4 L Hours per Week |
| Duration of SEE | 3 Hours |
| SEE | 60 Marks |
| CIE | 40 Marks |
| Credits | 4 |

**Objectives:** To enable the students to

1. Understand various terms related to manufacturing processes
2. Understand various manufacturing processes
3. Provide the ability to solve simple problems such as riser design and sheet metal calculations
4. Compare various Manufacturing processes
5. Select suitable manufacturing process for a given component

**Outcomes:** At the end of the course, a student will be able to

1. Define various terms related to manufacturing processes
2. Demonstrate the understanding of various manufacturing processes
3. Solve simple problems such as riser design and sheet metal calculations
4. Compare various manufacturing processes
5. Choose suitable manufacturing process for a given component

**UNIT – I**

**Manufacturing Processes:** Classification and importance.

**Casting:** Introduction, Classification of casting processes, Types of patterns, Pattern materials, Pattern allowances, Elements of gating system, Types of gates, Purpose and requirements of riser, Chvorinov's rule, Optimum shape and dimensions of riser, Riser design by Caine's method and Modulus method.

**UNIT - II**

**Moulding and Melting:** Moulding sand and its ingredients, Required properties of moulding sand, Core and core prints, Melting by Cupola furnace, Induction and arc furnace, Casting defects and remedies

**Special Casting Processes:** Pressure die casting, Centrifugal casting, shell moulding, Investment casting and $CO_2$ moulding.

**UNIT- III**

**Arc Welding:** Introduction to welding, Classification of welding processes, DCSP, DCRP, AC, shielded metal arc welding, Submerged arc welding, Gas Tungsten arc welding and gas metal arc welding,

**Resistance Welding:** Principle, Spot, Projection, Seam, Butt and percussion welding processes.

**Solid State Welding:** Friction welding, Ultrasonic welding and explosive welding

**Other Welding Processes**: Oxy-Acetylene welding, Laser beam welding, Electron beam welding, Soldering and brazing.

**UNIT – IV**

**Bulk Deformation Processes:** Open die, Closed die and isothermal forging processes, Rolling

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
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process, Nomenclature of rolling , Geometric relationships in rolling, Direct, indirect, hydrostatic and impact extrusion processes , Wire drawing process

**Sheet Metal Operations:** Shearing process, Shearing load, Energy required, Types of shearing processes, Cup drawing process, Calculation of blank diameter for a given cup, Drawing load, Sheet bending process and bend allowance.

**High Energy Rate Forming Processes:** Explosive forming, Electro-hydraulic forming and electromagnetic forming.

**UNIT – V**

**Additive Manufacturing:** Introduction, Stereolithography, Fused deposition modeling, Selective laser sintering and applications of additive manufacturing

**Powder Processing:** Introduction, Production of powders, Mixing, Blending, Compacting and Sintering, Merits, Demerits and application of powder metallurgy products.

**Processing of Plastics, Ceramics and Composites:** Injection moulding, Blow moulding and thermoforming of plastics, Injection moulding and slip casting of ceramics, Roll bending and filament winding of composites.

**Text Books:**

1. G.K. Lal and S.K. Choudhury., Fundamentals of Manufacturing Processes, Alpha science International Ltd., 2005.
2. Mikell P.Grover., Principle of Modern Manufacturing, 5th edition, Wiley , 2014,

**Suggested Reading:**

3. P.N. Rao., Manufacturing Technology, Vol.1, 3rd edition, Tata McGraw Hill Publ., 2011.
4. John Schey., Introduction to Manufacturing Processes, 2nd edition, McGraw Hill Education, 1999
5. Amitabh Ghosh and Mallick., Manufacturing Science, 4th edition, Assoc. East West Press Pvt. Ltd., 2011.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

With effect from the academic year 2022-23

## CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Scheme of Instruction as per R20 Curriculum

## B.E. (MECHANICAL ENGINEERING)

**SEMESTER – VI**

| S. No. | Course Code | Title of the Course | Scheme of instruction | | | Scheme of examination | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Hours per week | | | Duration in Hours | Maximum Marks | | |
| | | | L | T | P/D | | CIE | SEE | |
| **THEORY** | | | | | | | | | |
| 1 | 20MEC23 | Metrology and Instrumentation | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 2 | 20MEC24 | Machine Design | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 3 | 20MEC25 | Thermal Turbo Machines | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 4 | 20MEC26 | Finite Element Analysis | 3 | 1 | -- | 3 | 40 | 60 | 4 |
| 5 | | Professional Elective - III | 3 | -- | -- | 3 | 40 | 60 | 3 |
| **PRACTICALS** | | | | | | | | | |
| 6 | 20MEC27 | Metrology and Instrumentation Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| 7 | 20MEC28 | Machine Drawing Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| 8 | 20MEC29 | Production Drawing Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| 9 | 20MEC30 | Thermal Engineering Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| 10 | 20MEC31 | Finite Element Analysis Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| 11 | 20EGCO3 | Employability Skills Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| **TOTAL** | | | **15** | **01** | **12** | -- | **500** | **600** | **22** |

**L: Lecture T: Tutorial D: Drawing P: Practical**

**CIE - Continuous Internal Evaluation SEE – Semester End ExaminationA**

| **Professional Elective – III (3/3)** | | |
|---|---|---|
| **S.No.** | **Subject Code** | **Name of the Subject** |
| 1 | 20MEE09 | Computational Fluid Dynamics |
| 2 | 20MEE10 | Additive Manufacturing |
| 3 | 20MEE11 | Operations Research |
| 4 | 20MEE12 | Industrial Safety and Maintenance |

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
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**CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)**

Scheme of Instruction as per R20 Curriculum

**B.E. (MECHANICAL ENGINEERING)**

**SEMESTER – VII**

| S. No. | Course Code | Title of the Course | Scheme of instruction | | | Scheme of Examination | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Hours per week | | | Duration in Hours | Maximum Marks | | |
| | | | L | T | P/D | | CIE | SEE | |
| **THEORY** | | | | | | | | | |
| 1 | | Professional Elective - IV | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 2 | | Professional Elective - V | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 3 | | Open Elective - II | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 4 | | Open Elective – III | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 5 | 20EGM04 | Gender Sensitization | 2 | -- | -- | 2 | -- | 50 | *Non Credit |
| 6 | 20MBC01 | Engineering Economics and Accountancy | 3 | -- | -- | 3 | 40 | 60 | 3 |
| **PRACTICALS** | | | | | | | | | |
| 7 | 20MEC33 | Project Part-1 | -- | -- | 4 | -- | 50 | -- | 2 |
| | | Internship | 4-6 Weeks/ 180 hours | | | | | | 3 |
| **TOTAL** | | | **17** | **--** | **04** | **--** | **250** | **350** | **17+3** |

*L: Lecture T: Tutorial D: Drawing P: Practical*

**CIE - Continuous Internal Evaluation SEE – Semester End Examination**

| **Professional Elective – IV (3/3)** | | | **Professional Elective – V (3/3)** | | |
|---|---|---|---|---|---|
| S.No. | **Subject Code** | **Name of the Subject** | **S. No.** | **Subject Code** | **Name of the Subject** |
| 1 | 20MEE13 | Automobile Engineering | 1 | 20ME E17 | Renewable Energy Sources |
| 2 | 20MEE14 | Control System Theory | 2 | 20ME E18 | Digital Manufacturing and Industry 4.0 |
| 3 | 20MEE15 | Mechanical Vibrations | 3 | 20ME E19 | Composite Materials and Testing |
| 4 | 20MEE16 | Supply Chain Management | 4 | 20ME E20 | Block Chain Technology |

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Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
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**20MTC08**

## PARTIAL DIFFERENTIAL EQUATIONS AND STATISTICS

| | |
|---|---|
| Instruction | 3 L + 1THours per Week |
| Duration of SEE | 3 Hours |
| SEE | 60 Marks |
| CIE | 40 Marks |
| Credits | 4 |

**Objectives**:

1. To learn Numerical solution of ODE and Engineering problems.
2. To form PDE and to find its solution.
3. To know the model of wave and heat equations.
4. Able to fit the hypothetical data using probability distribution.
5. To learn fitting of distribution and predicting the future values.

**Outcomes:** On successful completion of this course the students shall be able to

1. Find solution of initial value problems of ODE by numerical method.
2. Solve Linear and non-linear PDE's.
3. Solve one-dimension wave and heat equations and two dimension Laplace equation.
4. Use the basic probability for fitting the Random phenomenon.
5. Analyze the random fluctuations of probability distribution and principles of least square approximations for the given data.

**UNIT-I:**

**Numerical Methods:** Solution of algebraic and transcendental equations by bisection method, Regula-Falsi method, Newton-Raphson method, Numerical solutions of first order ordinary differential equations by Taylor's series method, Euler's method, Modified Euler's method and Runge-Kutta method of fourth order.

**UNIT-II:**

**Partial Differential Equations:** Formation of partial differential equations, Linear equations of first order (Lagrange's linear equations), Solution of first order non-linear partial differential equation (standard forms) and Charpits method.

**UNIT-III:**

**Applications of Partial Differential Equations:** Solution by method of separation of variables, Solution of one dimensional wave equation, Solution of one dimensional heat equation, Solution of two dimensional Laplace equation and its related problems.

**UNIT-IV:**

**Basic Probability:** Basic probability, Conditional probability, Baye's theorem, Random variable, Discrete probability distribution and continuous probability distribution, Expectation, Addition and multiplication theorem of expectation, Properties of variance, Moments (moments about the mean and moments about a point)

**UNIT-V:**

**Probability Distributions and Curve Fitting:** Poisson distribution, MGF and cumulants of the Poisson distribution, Normal distribution, Characteristics of normal distribution MGF and CGF of normal distribution, Areas under normal curve, Correlation, Coefficient of correlation and lines of regression, Curve fitting by the method of least squares, Fitting of straight lines, Second degree parabola, Exponential and growth curves.

**Textbooks:**

1. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2017.
2. S.C.Gupta and V.K. Kappoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, 2014.

**Suggested Reading:**

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.
3. Sheldon Ross, A First Course in Probability, 9th Edition, Pearson publications, 2014.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

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**CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)**

**Scheme of Instruction as per R20 Curriculum**

**B.E. (MECHANICAL ENGINEERING)**

**SEMESTER – III**

| S. No. | Course Code | Title of the Course | Scheme of instruction | | | Scheme of examination | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Hours per week | | | Duration in Hrs | Maximum Marks | | |
| | | | L | T | P/D | | CIE | SEE | |
| THEORY | | | | | | | | | |
| 1 | 20MEC04 | Material Science And Metallurgy | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 2 | 20MEC05 | Strength of Materials | 3 | 1 | -- | 3 | 40 | 60 | 4 |
| 3 | 20MEC06 | Manufacturing Processes | 4 | -- | -- | 3 | 40 | 60 | 4 |
| 4 | 20MTC08 | Partial Differential Equations And Statistics | 3 | 1 | -- | 3 | 40 | 60 | 4 |
| 5 | 20CSC06 | Basics Of Data Structures | 2 | -- | -- | 3 | 40 | 60 | 2 |
| 6 | 20EGM03 | Universal Human Values II- Understanding Harmony | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 7 | 20CEM01 | Environmental Science | 2 | -- | -- | 2 | -- | 50 | *Non Credit |
| PRACTICALS | | | | | | | | | |
| 8 | 20MEC07 | Material Science and Metallurgy Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| 9 | 20MEC08 | Strength of Materials Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| 10 | 20MEC09 | Manufacturing Processes Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| 11 | 20CSC07 | Basic data structures Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| MOOCs/Training/Internship | | | 2-3 weeks/90 hours | | | | | | 2 |
| **TOTAL** | | | **21** | **02** | **06** | -- | **390** | **500** | **24+2** |

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE – Semester End Examination

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

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## CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Scheme of Instruction as per R20 Curriculum

## B.E. (MECHANICAL ENGINEERING)

**SEMESTER – V**

| S. No. | Course Code | Title of the Course | Scheme of instruction | | | Scheme of examination | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Hours per week | | | Duration in Hours | Maximum Marks | | |
| | | | L | T | P/D | | CIE | SEE | |
| **THEORY** | | | | | | | | | |
| 1 | 20MEC16 | Dynamics of Machines | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 2 | 20MEC17 | Applied Thermodynamics and HeatTransfer | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 3 | 20MEC18 | Design of Machine Elements | 3 | 1 | -- | 3 | 40 | 60 | 4 |
| 4 | 20MEC19 | CAD/CAM | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 5 | | Professional Elective - II | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 6 | | Open Elective - I | 3 | -- | -- | 3 | 40 | 60 | 3 |
| **PRACTICALS** | | | | | | | | | |
| 7 | 20MEC20 | Dynamics and Vibrations Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| 8 | 20MEC21 | Applied Thermodynamics and HeatTransfer Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| 9 | 20MEC22 | CAD/CAM Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| Industrial/Rural Internship | | | 3-4 weeks / 175 hours | | | | | | 2 |
| **TOTAL** | | | **18** | **01** | **06** | -- | **390** | **510** | **22+2** |

*L: Lecture* *T: Tutorial* *D: Drawing* *P: Practical*

**CIE - Continuous Internal Evaluation** **SEE – Semester End Examination**

| **Professional Elective – II(3/3)** | | |
|---|---|---|
| **S.No.** | **Subject Code** | **Name of the Subject** |
| 1 | 20MEE05 | Refrigeration and Air Conditioning |
| 2 | 20MEE06 | Robotic Engineering |
| 3 | 20MEE07 | Research Methodology and Innovation |
| 4 | 20MEE08 | Product Design and Process Planning |

PROFESSOR & HEAD
Department of Mechanical Engineer
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075. Tele

with effect from the Academic Year 2020-21

**20CS C01**

## PROGRAMMING FOR PROBLEM SOLVING
**(Common to all Programs)**

| | |
|---|---|
| Instruction | 3 Periods per week |
| Duration of SEE | 3Hours |
| SEE | 60 Marks |
| CIE | 40 Marks |
| Credits | 3 |

**Course Objectives:** The objectives of this course are

1. Identification of computer components, Operating environments, IDEs.
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
4. Develop in tuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

**Course Outcomes:** On Successful completion of the course, students will be able to

1. Identify and understand the computing environments for scientific and mathematical problems.
2. Formulate solutions to problems with alternate approaches and represent them using algorithms / Flowcharts.
3. Choose data types and control structures to solve mathematical and scientific problem.
4. Decompose a problem into modules and use functions to implement the modules.
5. Apply arrays, pointers, structures, and unions to solve mathematical and scientific problems.
6. Develop applications using file I/O.

**UNIT -I**

**Introduction to computers and Problem Solving**: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

**Introduction to programming**: Programming languages and generations, categorization of high-level languages.

**Introduction to C**: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence, and associativity.

**UNIT – II**

**Introduction to decision control statements**: Selective, looping, and nested statements.

**Functions**: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes, Case study using functions and control statements.

**UNIT – III**

**Arrays:** Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting (Selection and Bubble) algorithms, 2-D arrays, matrix operations.

**Strings:** Introduction, strings representation, string operations with examples. Case study using arrays.

**UNIT – IV**

**Pointers:** Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, dynamic memory allocation, advantages, and drawbacks of pointers.

**Structures:** Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions, and enumerated data types.

**UNIT-V**

**Files**: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.

**Preprocessor Directives**: Types of preprocessor directives, examples.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

**Text Books:**

1. M.T. Somashekar "Problem Solving with C", 2nd Edition, Prentice Hall India Learning Private Limited 2018
2. AK Sharma, "Computer Fundamentals and Programming", 2nd Edition, University Press, 2018
3. Pradeep Deyand Manas Ghosh, "Programming in C", Oxford Press, 2nd Edition, 2017

**Suggested Reading:**

1. Byron Gottfried, Schaum's Outline of Programming with C", Mc Graw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. ReemaTharaja "Introduction to C Programming", Second Edition, OXFORDPress,2015.

**Online Resources:**

1. https://www.tutorialspoint.com/cprogramming/index.htm.
2. https://onlinecourses.nptel.ac.in/noc18-cs10/preview

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

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## CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Scheme of Instruction as per R20 Curriculum

## B.E. (MECHANICAL ENGINEERING)

**SEMESTER – V**

| S. No. | Course Code | Title of the Course | Scheme of instruction | | | Scheme of examination | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Hours per week | | | Duration in Hours | Maximum Marks | | |
| | | | L | T | P/D | | CIE | SEE | |
| **THEORY** | | | | | | | | | |
| 1 | 20MEC16 | Dynamics of Machines | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 2 | 20MEC17 | Applied Thermodynamics and HeatTransfer | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 3 | 20MEC18 | Design of Machine Elements | 3 | 1 | -- | 3 | 40 | 60 | 4 |
| 4 | 20MEC19 | CAD/CAM | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 5 | | Professional Elective - II | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 6 | | Open Elective - I | 3 | -- | -- | 3 | 40 | 60 | 3 |
| **PRACTICALS** | | | | | | | | | |
| 7 | 20MEC20 | Dynamics and Vibrations Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| 8 | 20MEC21 | Applied Thermodynamics and HeatTransfer Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| 9 | 20MEC22 | CAD/CAM Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| Industrial/Rural Internship | | | 3-4 weeks / 175 hours | | | | | | 2 |
| **TOTAL** | | | **18** | **01** | **06** | -- | **390** | **510** | **22+2** |

*L: Lecture* *T: Tutorial* *D: Drawing* *P: Practical*

**CIE - Continuous Internal Evaluation** **SEE – Semester End Examination**

| Professional Elective – II(3/3) | | |
|---|---|---|
| **S.No.** | **Subject Code** | **Name of the Subject** |
| 1 | 20MEE05 | Refrigeration and Air Conditioning |
| 2 | 20MEE06 | Robotic Engineering |
| 3 | 20MEE07 | Research Methodology and Innovation |
| 4 | 20MEE08 | Product Design and Process Planning |

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

With effect from the Academic year 2022-23

| Open Elective-1 (3/3) | | |
|---|---|---|
| **S. No.** | **Subject Code** | **Name of the Subject** |
| 1 | 20ITO01 | Object Oriented Programming Using JAVA |
| 2 | 20CSO09 | Fundamentals of Database Management Systems |
| 3 | 20 EEO03 | Energy auditing |
| 4 | 20BT O01 | Biology for Engineers |
| 5 | 20MTO04B | Numerical Methods |

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

With effect from academic year 2021-2022

**CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)**

**Scheme of Instruction as per R20 Curriculum**

**B.E. (MECHANICAL ENGINEERING)**

**SEMESTER – III**

| S. No. | Course Code | Title of the Course | Scheme of instruction | | | Scheme of examination | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Hours per week | | | Duration in Hrs | Maximum Marks | | |
| | | | L | T | P/D | | CIE | SEE | |
| THEORY | | | | | | | | | |
| 1 | 20MEC04 | Material Science And Metallurgy | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 2 | 20MEC05 | Strength of Materials | 3 | 1 | -- | 3 | 40 | 60 | 4 |
| 3 | 20MEC06 | Manufacturing Processes | 4 | -- | -- | 3 | 40 | 60 | 4 |
| 4 | 20MTC08 | Partial Differential Equations And Statistics | 3 | 1 | -- | 3 | 40 | 60 | 4 |
| 5 | 20CSC06 | Basics Of Data Structures | 2 | -- | -- | 3 | 40 | 60 | 2 |
| 6 | 20EGM03 | Universal Human Values II- Understanding Harmony | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 7 | 20CEM01 | Environmental Science | 2 | -- | -- | 2 | -- | 50 | *Non Credit |
| PRACTICALS | | | | | | | | | |
| 8 | 20MEC07 | Material Science and Metallurgy Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| 9 | 20MEC08 | Strength of Materials Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| 10 | 20MEC09 | Manufacturing Processes Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| 11 | 20CSC07 | Basic data structures Lab | -- | -- | 2 | 3 | 50 | 50 | 1 |
| MOOCs/Training/Internship | | | 2-3 weeks/90 hours | | | | | | 2 |
| **TOTAL** | | | **21** | **02** | **06** | -- | **390** | **500** | **24+2** |

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE – Semester End Examination

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

With effect from the Academic year 2022-23

| Open Elective-1 (3/3) | | |
|---|---|---|
| **S. No.** | **Subject Code** | **Name of the Subject** |
| 1 | 20ITO01 | Object Oriented Programming Using JAVA |
| 2 | 20CSO09 | Fundamentals of Database Management Systems |
| 3 | 20 EEO03 | Energy auditing |
| 4 | 20BT O01 | Biology for Engineers |
| 5 | 20MTO04B | Numerical Methods |

PROFESSOR & HEAD
Department of Mechanical Engineering
Bharatiya Bharathi Institute of Technology (A)
Bollaram, Hyderabad-500 075, Telangana

# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

## Scheme of Instructions of I Semester of B.E. – Mechanical Engineering as per AICTE Model Curriculum 2022-23

### DEPARTMENT OF MECHANICAL ENGINEERING

**SEMESTER – I**

| S. No | Course Code | Title of the Course | Scheme of Instruction | | | Credits |
|---|---|---|---|---|---|---|
| | | | Hours per Week | | | |
| | | | L | T | P/D | |
| **THEORY** | | | | | | |
| 1 | 22MTC02 | Calculus | 3 | 1 | 0 | 4 |
| 2 | 22CYC01 | Chemistry | 3 | 0 | 0 | 3 |
| 3 | 22EEC01 | Basic Electrical Engineering | 2 | 1 | 0 | 3 |
| 4 | 22CSC01 | Problem Solving and Programming | 2 | 1 | 0 | 3 |
| **PRACTICAL** | | | | | | |
| 5 | 22CYC02 | Chemistry Lab | 0 | 0 | 3 | 1.5 |
| 6 | 22MBC02 | Community Engagement | 0 | 0 | 3 | 1.5 |
| 7 | 22CSC02 | Problem Solving and Programming Lab | 0 | 0 | 3 | 1.5 |
| 8 | 22MEC37 | Robotics & Drones Lab | 0 | 2 | 2 | 3 |
| 9 | 22EEC02 | Basic Electrical Engineering Lab | 0 | 0 | 2 | 1 |
| **TOTAL** | | | **10** | **5** | **13** | **21.5** |

**L: Lecture** **T: Tutorial** **D: Drawing** **P: Practical**

**CIE - Continuous Internal Evaluation** **SEE - Semester End Examination**

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

**Scheme of Instructions of II Semester of B.E. – Mechanical Engineering as per AICTE Model Curriculum 2022-23**

## DEPARTMENT OF MECHANICAL ENGINEERING

**SEMESTER -II**

| S. No | Course Code | Title of the Course | Scheme of Instruction | | | Credits |
|---|---|---|---|---|---|---|
| | | | Hours per Week | | | |
| | | | L | T | P/D | |
| **THEORY** | | | | | | |
| 1 | 22MTC05 | Vector Calculus and Differential Equations | 3 | 1 | 0 | 4 |
| 2 | 22PYC05 | Mechanics and Materials Science | 3 | 0 | 0 | 3 |
| 3 | 22CEC01 | Engineering Mechanics | 3 | 1 | 0 | 4 |
| 4 | 22EGC01 | English | 2 | 0 | 0 | 2 |
| **PRACTICAL** | | | | | | |
| 5 | 22PYC08 | Mechanics and Materials Science Lab | 0 | 0 | 3 | 1.5 |
| 6 | 22EGC02 | English lab | 0 | 0 | 2 | 1 |
| 7 | 22MEC01 | CAD AND DRAFTING | 0 | 1 | 3 | 2.5 |
| 8 | 22MEC38 | Digital Fabrication Lab | 0 | 0 | 3 | 1.5 |
| **TOTAL** | | | **11** | **3** | **11** | **19.5** |

**L: Lecture** **T: Tutorial** **D: Drawing** **P: Practical**

**CIE - Continuous Internal Evaluation** **SEE - Semester End Examination**

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

With effect from the academic year 2023-24

## CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Scheme of Instruction as per R20 Curriculum

## B.E. (MECHANICAL ENGINEERING)

### SEMESTER – VII

| S. No. | Course Code | Title of the Course | Scheme of instruction | | | Scheme of Examination | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Hours per week | | | Duration in Hours | Maximum Marks | | |
| | | | L | T | P/D | | CIE | SEE | |
| **THEORY** | | | | | | | | | |
| 1 | | Professional Elective - IV | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 2 | | Professional Elective - V | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 3 | | Open Elective - II | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 4 | | Open Elective – III | 3 | -- | -- | 3 | 40 | 60 | 3 |
| 5 | 20EGM04 | Gender Sensitization | 2 | -- | -- | 2 | -- | 50 | *Non Credit |
| 6 | 20MBC01 | Engineering Economics and Accountancy | 3 | -- | -- | 3 | 40 | 60 | 3 |
| **PRACTICALS** | | | | | | | | | |
| 7 | 20MEC33 | Project Part-1 | -- | -- | 4 | -- | 50 | -- | 2 |
| | | Internship | 4-6 Weeks/ 180 hours | | | | | | 3 |
| **TOTAL** | | | **17** | **--** | **04** | **--** | **250** | **350** | **17+3** |

*L: Lecture* *T: Tutorial* *D: Drawing* *P: Practical*

**CIE - Continuous Internal Evaluation** **SEE – Semester End Examination**

| **Professional Elective – IV (3/3)** | | | **Professional Elective – V (3/3)** | | |
|---|---|---|---|---|---|
| S.No. | **Subject Code** | **Name of the Subject** | **S. No.** | **Subject Code** | **Name of the Subject** |
| 1 | 20MEE13 | Automobile Engineering | 1 | 20ME E17 | Renewable Energy Sources |
| 2 | 20MEE14 | Control System Theory | 2 | 20ME E18 | Digital Manufacturing and Industry 4.0 |
| 3 | 20MEE15 | Mechanical Vibrations | 3 | 20ME E19 | Composite Materials and Testing |
| 4 | 20MEE16 | Supply Chain Management | 4 | 20ME E20 | Block Chain Technology |

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

| Open Elective-II (3/3) | | |
|---|---|---|
| **S. No.** | **Subject Code** | **Name of the Subject** |
| 1 | 20CSO05 | Basics of Artificial Intelligence |
| 2 | 20CH O06 | Fundamentals of Fuel Cells |
| 3 | 20CEO02 | Disaster and Risk Reduction Management |
| 4 | 20ECO05 | System Automation and Control |
| 5 | 20EGO01 | Technical Writing Skills |

| Open Elective-III (3/3) | | |
|---|---|---|
| **S. No.** | **Subject Code** | **Name of the Subject** |
| 1 | 20ITO02 | Principles of Internet of Things |
| 2 | 20CSO02 | Introduction to Web Technology |
| 3 | 20ECO04 | Principles of Embedded Systems |
| 4 | 20PYO01 | History of Science and Technology |
| 5 | 20ADO01 | Introduction to Python Programming |

PROFESSOR & HEAD
Department of Mechanical Engineering
Bharatiya Bharathi Institute of Technology (A)
Medipet, Hyderabad-500 075. Telangana

# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS), HYDERABAD-75

**Date: 02.08.2022**

## GUIDELINES FOR B.E. / B.TECH. – VII - SEMESTER INTERNSHIPS

1. Students of B.E. / B.Tech. – VII - Semester are allowed to pursue internships if they have applied through proper channel and are selected through ON/OFF campus.
2. The candidates are permitted to undergo internships only after submission of an affidavit in the specified format. The parents shall sign on the affidavit in presence of concerned Head of the Department. The internship affidavit format can be downloaded from the Institute Website.
3. The student selected for internships either ON / OFF Campus shall attach official email communication from the concerned company addressed to HOD and Director-CDC to the affidavit.
4. The student shall be considered for permission with the recommendations of the concerned Head of the department and Director-CDC. The Heads of the Departments and Director-CDC are expected to thoroughly verify the cases before making their recommendations.
5. Heads the Department shall maintain the records of the following:
   a. Internships through TPO (Minimum and Maximum period of Internships)
   b. Off campus internships (Minimum and Maximum period of Internships)
   c. Internships converted into Full Time Employment (FTE)
   d. List of companies/ organizations offered internships (off and on campus separately)
   e. Outcomes (Projects / Products / Start-ups / Publications / Special Appreciations, etc.)
6. Heads of the departments shall submit the required data to the Principal / Director-Academics whenever required.
7. The student is responsible to get the evaluation of CIE of Lab Courses and Assignments & Slip Tests of Theory Courses from the respective faculty.
8. Students are responsible to get the weekly attendance of the Internships attended and submit the same to the concerned HoD on every Saturday.
9. Students shall apply for permission through the concerned Head of the Department at least 6 working days prior to the commencement of internship.

02/08/2022

**PRINCIPAL**

**Encl:** Affidavit by the Student and Parent.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana