
# Faculty of Engineering & Technology

## Syllabus

**For**

## Bachelor of Technology (B. Tech.)

**in**

## Mechanical Engineering

***(Program Code: ET0141)***

**(2019-20)**

***(Approved by the Academic Council vide Resolution No. 34.26 dated 20.06.2019)***

# INDEX

## 1. Program Educational Objectives (PEOs):

The program educational objectives are set in line with Institutional and Departmental mission statements. The program educational objectives of Bachelor of Technology is to produce engineers who later take the responsibility of engineering professionals and researchers with following qualities:

- **PEO1.** Apply basic knowledge of mathematics, principles of physics and chemistry, and interdisciplinary engineering for the design and development.
- **PEO2.** Demonstrate the application of exploration practices and engineering principles through development of innovative tools that are beneficial in production.
- **PEO3.** Exhibit skills of design and construct machineries based on requirement and need of Technology operations.
- **PEO4.** Exhibit strong, independent learning, analytical and problem solving skills with special emphasis on design, communication, and ability to work in teams.
- **PEO5.** To have successful career as engineering professional or a researcher through lifelong learning in the field of Bachelor of Technology.

## 2. Graduation Attributes (GAs)

The graduate attributes in B. Tech. are the summation of the expected course learning outcomes mentioned in the end of each course. Some of them are stated below.

**GA1: Discipline-specific Knowledge:**

Capability of demonstrating comprehensive knowledge of B. Tech. program and understanding of core branch so that it forms a foundation for a graduate program of study.

**GA2: Critical Thinking & Analytical Reasoning:**

Ability to employ critical thinking in understanding the concepts relevant to the various branches of engineering. Ability to analyze the results and apply them in various problems appearing in different streams.

**GA3: Problem Solving:**

Capability to solve problems by using research-based knowledge and research methods including innovative thinking, design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**GA4: Research-related skills:**

To develop a sense of inquiry and capability for asking relevant and intelligent questions, problem identification, synthesizing and articulating; ability to recognize and establish cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.

**GA5: Usage of Modern Tools (Information/digital literacy):**

To create, select, and apply appropriate techniques, resources, and modern science and IT tools including prediction and modeling to complex science activities with an understanding of the limitations.

**GA6: Social Responsibilities:**

Ability to work with contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**GA7: Self-directed learning with environment:**

Ability to work independently and doin-depth study of variousproblems and requirements of society with natural available resources which leads to sustainable development.

**GA8. Moral and ethical awareness/reasoning:**

Ability to identify unethical behavior such as falsification or misrepresentation of data and adopting objective, unbiased and truthful actions in all aspects of their program.

**GA9. Leadership Readiness/Qualities:**

Capability for mapping out the tasks in a team or an organization, self-motivating and inspiring team members to engage with the team objectives/vision; and using management skills to follow the mapped path to the destination in a smooth and efficient way.

**GA10: Communication skills:**

a. Ability to communicate various concepts of technical education effectively using practical approach and their geometrical visualizations.

b. Ability to use courses as a precise language of communication in other branches of human knowledge.

c. Ability to resolve unsolved problems and requirements of industries and societies.

d. Ability to show the importance of their technical knowledge as precursor to various scientific developments since the beginning of the civilization.

**GA11: Project Management and Finance:**

Ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

**GA12: Lifelong learning:**

Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.

## 3. Program Outcomes (POs)

Students graduating with the B. Tech. degree should be able to acquire with following POs

**PO1.** **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2.** **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3.** **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4.** **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5.** **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6.** **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7.** **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8.** **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9.** **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10.** **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11.** **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12.** **Lifelong learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**Mapping of Graduate Attributes (GAs) and Program Outcomes (POs):**

| PO/GA | GA1 | GA2 | GA3 | GA4 | GA5 | GA6 | GA7 | GA8 | GA9 | GA10 | GA11 | GA12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PO1 | ■ | | | | | | | | | | | |
| PO2 | | ■ | | | | | | | | | | |
| PO3 | | | ■ | | | | | | | | | |
| PO4 | | | | ■ | | | | | | | | |
| PO5 | | | | | ■ | | | | | | | |
| PO6 | | | | | | ■ | | | | | | |
| PO7 | | | | | | | ■ | | | | | |
| PO8 | | | | | | | | ■ | | | | |
| PO9 | | | | | | | | | ■ | | | |
| PO10 | | | | | | | | | | ■ | | |
| PO11 | | | | | | | | | | | ■ | |
| PO12 | | | | | | | | | | | | ■ |

## 4. Program Specific Outcomes (PSOs) :

**PSO1:** Professionally empowering the student as technical manpower in industry or an entrepreneur for production analytics and innovation.

**PSO2:** Able to excel in various technological challenges and contribute for self-reliant society.

## 5. Course-Wise Learning Objectives, Structures and Outcomes (CLOSOs)

# BACHELOR OF TECHNOLOGY

## Semester - I

| THEORY PAPERS | | No. of Teaching Hours | | | Marks Allocation | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Subject/Paper** | L | T | P | IA | EA | Total | **Credits** |
| BTBSC 101 | Engineering Mathematics-I | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTBSC 102 | Engineering Physics | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTHSMC 103 | Communication Skills | 2 | - | - | 30 | 70 | 100 | 2 |
| BTESC 104 | Programming for Problem Solving | 2 | - | - | 30 | 70 | 100 | 2 |
| BTESC 105A/ BTESC 105B | Basic Electrical Engineering/ Basic Civil Engineering | 2 | - | - | 30 | 70 | 100 | 2 |
| **PRACTICALS/ VIVA VOCE** | | **No. of Teaching Hours** | | | **Sessional** | **Practical** | **Total** | **Credits** |
| BTBSC 106 | Engineering Physics Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTHSMC 107 | Language Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTESC 108 | Computer Programming Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTESC109A/ BTESC109B | Basic Electrical Engineering Lab/ Basic Civil Engineering Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTESC 110 | Computer Aided Engineering Graphics | - | - | 2 | 30 | 20 | 50 | 1 |
| BTSODECA111 | Social Outreach, Discipline & Extra Curricular Activities | - | - | - | - | - | 50 | 1 |
| | **Total** | **12** | **2** | **10** | **300** | **450** | **800** | **20** |

## Semester – II

| THEORY PAPERS | | No. of Teaching Hours | | | Marks Allocation | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Subject/Paper** | L | T | P | IA | EA | Total | **Credits** |
| BTBSC 201 | Engineering Mathematics-II | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTBSC 202 | Engineering Chemistry | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTHSMC 203 | Human Values | 2 | - | - | 30 | 70 | 100 | 2 |
| BTESC 204 | Basic Mechanical Engineering | 2 | - | - | 30 | 70 | 100 | 2 |
| BTESC205A/ BTESC205B | Basic Electrical Engineering/ Basic Civil Engineering | 2 | - | - | 30 | 70 | 100 | 2 |
| BTHSMC 206 | Advanced English | 2 | - | - | 30 | 70 | 100 | 2 |
| **PRACTICALS/ VIVA VOCE** | | No. of Teaching Hours | | | Sessional | Practical | Total | Credits |
| BTBSC 207 | Engineering Chemistry Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTHSMC 208 | Human Values Activities | - | - | 2 | 30 | 20 | 50 | 1 |
| BTESC 209 | Manufacturing Practices Workshop | - | - | 2 | 30 | 20 | 50 | 1 |
| BTESC210A/ BTESC 210B | Basic Electrical Engineering Lab/ Basic Civil Engineering Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTESC 211 | Computer Aided Machine Drawing | - | - | 2 | 30 | 20 | 50 | 1 |
| BTSODECA212 | Social Outreach, Discipline & Extra Curricular Activities | - | - | - | - | - | 50 | 1 |
| | **Total** | **14** | **2** | **12** | **330** | **520** | **900** | **22** |

## SEMESTER: III

| THIRD SEMESTER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| THEORY PAPERS | | No. of Teaching Hours | | | Marks Allocation | | | |
| Code | Subject/Paper | L | T | P | IA | EA | Total | Credits |
| BTMEBSC301 | Advance Engineering Mathematics-I | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEHSMC302 | Managerial Economics & Financial Accounting | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEESC303 | Engineering Mechanics | 3 | 1 | 0 | 30 | 70 | 100 | 4 |
| BTMEPCC304 | Engineering Thermodynamics | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEPCC305 | Materials Science and Engineering | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEPCC306 | Mechanics of Solids | 3 | 1 | 0 | 30 | 70 | 100 | 4 |
| | **Sub Total** | **18** | **2** | **0** | **180** | **420** | **600** | **20** |
| **PRACTICALS/VIVA-VOCE** | | **No. of Teaching Hours** | | | **IA** | **EA** | **Total** | **Credits** |
| BTMEPCC307 | Machine drawing practice | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC308 | Materials Testing Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC309 | Basic Mechanical Engineering Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC310 | Programming using MATLAB | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPSIT311 | Industrial Training/ Seminar | - | - | - | 30 | 20 | 50 | 1 |
| BTMESODECA312 | Social Outreach, Discipline & Extra Curricular Activities | | | 0 | 0 | 0 | 50 | 1 |
| | **Sub Total** | | | **8** | **150** | **100** | **300** | **6** |
| **TOTAL** | | **18** | **2** | **8** | **330** | **520** | **900** | **26** |

## SEMESTER IV

| FOURTH SEMESTER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **THEORY PAPERS** | | **No. of Teaching Hours** | | | **Marks Allocation** | | | |
| **Code** | **Subject/Paper** | L | **T** | **P** | **IA** | **EA** | **Total** | **Credits** |
| BTMEBSC401 | Data Analytics | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEHSMC402 | Technical Communications | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEESC403 | Digital Electronics | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTMEPCC404 | Fluid Mechanics & Fluid Machines | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTMEPCC405 | Manufacturing Processes | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTMEPCC406 | Theory Of Machines | 3 | 1 | - | 30 | 70 | 100 | 4 |
| ***PRACTICALS/VIVA-VOCE*** | | **No. of Teaching Hours** | | | **Sessional** | **Practical** | **Total** | **Credits** |
| BTMEPCC407 | **Digital Electronics** Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC408 | Fluid Mechanics Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC409 | Production Practice Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC410 | Theory Of Machine Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMESODECA411 | Social Outreach, Discipline & Extra Curricular Activates | - | - | - | - | - | 50 | 1 |
| **TOTAL** | | 18 | **4** | **8** | **330** | **500** | **850** | **27** |

# Semester V

| BACHELOR OF TECHNOLOGY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| MECHANICAL ENGINEERING | | | | | | | | |
| FIFTH SEMESTER | | | | | | | | |
| **THEORY PAPERS** | | **No. of Teaching Hours** | | | **Marks Allocation** | | | |
| **Code** | **Subject/Paper** | L | **T** | **P** | **IA** | **EA** | **Total** | **Credits** |
| **BTMEPCC501** | **Mechatronics Systems** | 3 | - | - | 30 | 70 | 100 | 4 |
| BTMEPCC502 | Heat Transfer | 3 | 1 | - | 30 | 70 | 100 | 3 |
| BTMEPCC503 | Manufacturing Technology | 3 | - | - | 30 | 70 | 100 | 4 |
| BTMEPCC504 | Design Of Machine Elements I | 3 | 1 | - | 30 | 70 | 100 | 3 |
| BTMEPCC505 | Principles Of Management | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEPCC506.A | Steam Engineering | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEPCC506.B | Automobile Engineering | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEPCC506.C | Non Destructive Evaluation & Testing | 3 | - | - | 30 | 70 | 100 | 3 |
| ***PRACTICALS/VIVA-VOCE*** | | **No. of Teaching Hours** | | | **Sessional** | **Practical** | **Total** | **Credits** |
| BTMEPCC507 | Mechatronics Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC508 | Heat Transfer Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC509 | Production Engineering Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC510 | Machine Design Practice Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPSIT511 | Industrial Training/ Seminar | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMESODECA512 | Social Outreach, Discipline & Extra Curricular Activities | - | - | - | - | - | 50 | 1 |
| **TOTAL** | | 18 | **2** | **10** | **330** | **520** | **900** | **26** |

## Semester VI

| BACHELOR OF TECHNOLOGY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **MECHANICAL ENGINEERING** | | | | | | | | |
| **SIXTH SEMESTER** | | | | | | | | |
| **THEORY PAPERS** | | **No. of Teaching Hours** | | | **Marks Allocation** | | | |
| **Code** | **Subject/Paper** | L | **T** | **P** | **IA** | **EA** | **Total** | **Credits** |
| BTMEPCC601 | Measurement & Metrology | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEPCC602 | Computer Integrated Manufacturing Systems | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEPCC603 | Mechanical Vibrations | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTMEPCC604 | Design of Machine Elements II | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTMEPCC605 | Quality Management | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMPCCE606.A | Refrigeration & Air Conditioning | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEPCC606.B | Non Conventional Machining Methods | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEPCC606.C | Micro electro and mechanical systems (MEMS) and Microsystems | 3 | - | - | 30 | 70 | 100 | 3 |
| ***PRACTICALS/VIVA-VOCE*** | | **No. of Teaching Hours** | | | **Sessional** | **Practical** | **Total** | **Credits** |
| BTMEPCC607 | CIMS Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC608 | Vibration Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC609 | Machine Design Practice II Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC610 | Thermal Engineering Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPSIT611 | Industrial Training/ Seminar | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMESODECA612 | Social Outreach, Discipline & Extra Curricular Activities | - | - | - | - | - | 50 | 1 |
| **TOTAL** | | 18 | **2** | **12** | **330** | **520** | **900** | **26** |

## Semester - VII

| THEORY PAPERS | | No. of Teaching Hours | | | Marks Allocation | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Subject/Paper** | L | T | P | IA | EA | Total | Credits |
| BTMEPEC701.A | I.C. Engines | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEPEC701.B | Operation Research | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEPEC701.C | Turbomachines | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| ***Open Elective – I (Choose Any One Subject)*** | | | | | | | | |
| BTMEOEC702.A | Non Destructive System | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEOEC702.B | Environmental Engineering and Disaster | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEOEC702.C | Power Generation Sources | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| ***PRACTICALS/VIVA-VOCE*** | | **No. of Teaching Hours** | | | **Sessional** | **Practical** | **Total** | **Credits** |
| BTMEPCC703 | FEA Lab | 0 | 0 | 3 | 30 | 20 | 50 | 1 |
| BTMEPCC704 | Thermal Engineering Lab-II | 0 | 0 | 3 | 30 | 20 | 50 | 1 |
| BTMEPCC705 | Quality Control Lab | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| BTMEPSIT706 | Industrial Training | 1 | 0 | 0 | 60 | 40 | 100 | 2 |
| BTMEPSIT707 | Seminar | 2 | 0 | 0 | 60 | 40 | 100 | 2 |
| BTMESODECA708 | Social Outreach, Discipline & Extra Curricular Activity | - | - | - | - | - | 50 | 1 |
| **TOTAL** | | 9 | **0** | **8** | **270** | **280** | **600** | 14 |

## Semester – VIII

| THEORY PAPERS | | No. of Teaching Hours | | | Marks Allocation | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Subject/Paper** | L | **T** | **P** | **IA** | **EA** | **Total** | **Credits** |
| BTMEPEC801.A | Hybrid and Electric Vehicles | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEPEC801.B | Supply and Operations Management | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEPEC801.C | Additive Manufacturing | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| ***Open Elective – II (Choose Any One Subject)*** | | | | | | | | |
| BTMEOEC802.A | Finite Elements Methods | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEOEC802.B | Energy Management | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEOEC802.C | Waste and By-product Utilization | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| | | | | | | | | |
| ***PRACTICALS/VIVA-VOCE*** | | **No. of Teaching Hours** | | | **Sessional** | **Practical** | **Total** | **Credits** |
| BTMEPCC803 | Industrial Engineering Lab | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC804 | Metrology Lab | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| BTMEPSIT805 | Project | 3 | 0 | 0 | 150 | 100 | 250 | 5 |
| BTMESODECA806 | Social Outreach, Discipline & Extra Curricular Activity | 0 | 0 | 0 | 0 | 0 | 50 | 1 |
| **TOTAL** | | **9** | **0** | **4** | **240** | **260** | **600** | **14** |

# BTBSC101: Engineering Mathematics-I

**Course Objectives:**

- To familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra.
- To equip the students with standard concepts and tools at an intermediate to advanced level
- To understand Fourier series representation of Periodic signals and to introduce with Fourier Series.

**Unit I:** ***Calculus:***

Improper integrals (Beta and Gamma functions) and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

**Unit II: Sequences and Series:**

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

**Unit III: Fourier Series:**

Periodic functions, Fourier series, Euler's formula, Change of intervals, Half range sine and cosine series, Parseval's theorem.

**Unit IV: Multivariable Calculus (Differentiation):**

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

**Unit V: Multivariable Calculus (Integration):**

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to), Applications: areas and volumes, Centre of mass and Gravity constant and variable densities); Triple integrals (Cartesian), Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, surface integrals, Theorems of Green, Gauss and Stokes.

**Textbooks/References:**


1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edit ion, John Wiley & Sons, 2006. F201
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.


**Course Outcomes:**

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

CO1: Understand the calculation and Applications of definite integrals.

CO2: Solve problems related to Sequences and Series.

CO3: Interpret the concept of s series as the sum of a sequence and able to solve problems related to Fourier series.

CO4: Interpret the concept of s series as the sum of a sequence and use the sequence of partial sums to determine divergence of a series.

CO5: Understand the calculation and Applications of Multivariable integrals.

**Mapping between Objectives and Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | L | M | L | - | - | - | - | M | - | L | H | M |
| CO2 | L3 | - | M | H | M | - | - | - | - | - | M | - | L | M | L |
| CO3 | L4 | H | L | M | L | - | - | - | - | - | - | - | L | H | M |
| CO4 | L4 | H | L | M | L | - | - | - | - | - | - | - | L | H | M |
| CO5 | L2 | H | M | L | M | L | - | - | - | - | M | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## Semester - I

| THEORY PAPERS | | No. of Teaching Hours | | | Marks Allocation | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Subject/Paper** | L | T | P | IA | EA | Total | **Credits** |
| BTBSC 101 | Engineering Mathematics-I | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTBSC 102 | Engineering Physics | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTHSMC 103 | Communication Skills | 2 | - | - | 30 | 70 | 100 | 2 |
| BTESC 104 | Programming for Problem Solving | 2 | - | - | 30 | 70 | 100 | 2 |
| BTESC 105A/ BTESC 105B | Basic Electrical Engineering/ Basic Civil Engineering | 2 | - | - | 30 | 70 | 100 | 2 |
| **PRACTICALS/ VIVA VOCE** | | **No. of Teaching Hours** | | | **Sessional** | **Practical** | **Total** | **Credits** |
| BTBSC 106 | Engineering Physics Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTHSMC 107 | Language Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTESC 108 | Computer Programming Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTESC109A/ BTESC109B | Basic Electrical Engineering Lab/ Basic Civil Engineering Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTESC 110 | Computer Aided Engineering Graphics | - | - | 2 | 30 | 20 | 50 | 1 |
| BTSODECA111 | Social Outreach, Discipline & Extra Curricular Activities | - | - | - | - | - | 50 | 1 |
| | **Total** | **12** | **2** | **10** | **300** | **450** | **800** | **20** |

# BTBSC102: Engineering Physics

**Course Objective:**

- To understand the concepts of interference, Diffraction and Polarization.
- To know about wave particle duality.
- To know applications of Optical fibre.
- To know applications of Lasers in Science, engineering and medicine.
- To know classification of Solid.

**Unit I: Wave Optics**

Newton's Rings, Michelson's Interferometer, Fraunhofer Diffraction from a Single Slit. Diffraction grating: Construction, theory and spectrum, Resolving power and Rayleigh criterion for limit of resolution, Resolving power of diffraction grating, X-Ray diffraction and Bragg's Law.

**Unit II: Quantum Mechanics**

Introduction to quantum Mechanics, Wave-particle duality, Matter waves, Wave function and basic postulates, Time dependent and time independent Schrodinger's Wave Equation, Physical interpretation of wave function and its properties, Applications of the Schrodinger's Equation: Particle in one dimensional and three dimensional boxes.

**Unit III: Coherence and Optical Fibers**

Spatial and temporal coherence: Coherence length; Coherence time and 'Q' factor for light, Visibility as a measure of Coherence and spectral purity, Optical fiber as optical wave guide, Numerical aperture; Maximum angle of acceptance and applications of optical fiber.

**Unit IV: Laser**

Einstein's Theory of laser action; Einstein's coefficients; Properties of Laser beam, Amplification of light by population inversion, Components of laser, Construction and working of He-Ne and semiconductor lasers, Applications of Lasers in Science, engineering and medicine.

**Unit V: Material Science & Semiconductor Physics**

Bonding in solids: covalent and metallic bonding, Energy bands in solids: Classification of solids as Insulators, Semiconductors and Conductors, Intrinsic and extrinsic semiconductors, Fermi dirac distribution function and Fermi energy, Conductivity in semiconductors, Hall Effect: Theory, Hall Coefficient and applications.

**References**:


1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).

5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Online course: “Semiconductor Optoelectronics” by M R Shenoy on NPTEL
7. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Guptaon NPTEL

**Course Outcomes:**

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

CO1: Enhance the basic skills required to understand, develop, and design various engineering applications involving Wave Optics.

CO2: Understand Quantum Mechanics and apply them to diverse engineering problems.

CO3: Analyze the nature of light propagation in guided medium for engineering applications and study in Coherence and Optical Fibers.

CO4: Describe different Laser problems.

CO5: Describe Material Science & Semiconductor Physics.

**Table: Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom’s Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | H | - | H | - | M | - | - | - | - | L | H | M |
| CO2 | L3 | H | H | H | H | - | M | - | - | - | - | - | - | M | M |
| CO3 | L4 | M | L | M | - | L | - | L | - | - | - | - | - | H | H |
| CO4 | L2 | H | M | H | H | M | - | M | L | - | L | - | L | H | M |
| CO5 | L2 | H | M | H | H | M | - | M | L | - | L | - | L | M | H |

**H- High, M- Moderate, L- Low, ‘-’ for No correlation**

# BTHSMC103: Communication Skills

**Course Objective:**

- To improve communication skills with Basic English.
- To know different types of communication.
- To develop basic skills needed for writing short stories and poems.

**Detailed contents :**

**Unit I: Communication**

Meaning, Importance and Cycle of Communication. Media and Typesof Communication. Verbal and Non-Verbal Communication.Barriers to communication. Formal and Informal Channels ofCommunication (Corporate Communication). Divisions of HumanCommunication and Methods to improve InterpersonalCommunication. Qualities of good communication.

**Unit II: Grammar**

Passive Voice. Reported Speech. Conditional Sentences. Modal Verbs. Linking Words (Conjunctions)

**Unit III: Composition**

Job Application and Curriculum-Vitae Writing. Business LetterWriting. Paragraph Writing. Report Writing.

**Unit IV: Short Stories**

"Luncheon" by Somerset Maugham."How Much Land Does a ManNeed?" by Count Leo Tolstoy. "The Night Train at Deoli" by RuskinBond.

**Unit V: Poems**

"No Men are Foreign" by James Kirkup. "If" by Rudyard Kipling."Where the Mind is without Fear" by Rabindranath Tagore.

**Text / Reference Books Suggested Readings:**


(i) Practical English Usage. Michael Swan. OUP. 1995.
(ii) Remedial English Grammar. F.T. Wood. Macmillan.2007
(iii) On Writing Well. William Zinsser. Harper Resource Book. 2001
(iv) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press


**Course Outcomes:**

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

CO1: Understand Communication and Types of Communication.

CO2: Know Grammar of Passive Voice, Reported Speech.

CO3: Understand different ways of writing Job Application and Curriculum-Vitae.

CO4: Describe different Short Stories for effective Learning.

CO5: Describe different poems for improving communication skills.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | - | - | - | - | L | M | - | - | - | H | - | M | M | L |
| CO2 | L1 | - | - | - | - | - | H | - | - | - | H | - | L | M | M |
| CO3 | L2 | - | - | - | - | - | M | - | - | M | H | - | M | M | L |
| CO4 | L2 | - | - | - | - | - | M | - | - | - | H | - | L | M | M |
| CO5 | L2 | - | - | - | - | - | M | - | - | - | H | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTESC104: Programming for Problem Solving

**Course Objective:**

- To learn the fundamentals of computers.
- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

## Syllabus

**UNIT I:Fundamentals of Computer:**

Stored program architecture of computers, Storage device- Primarymemory, and Secondary storage, Random, Direct, Sequential access methods.

**UNIT II:**

Concepts of High-level, Assembly and Low-level languages,Representing algorithms through flowchart and pseudo code.

**UNIT III:Number system:**

Data representations, Concepts of radix and representation ofnumbers in radix r with special cases of r=2, 8, 10 and 16 withconversion from radix r1 to r2, r's and (r-1)'s complement, Binaryaddition, Binary subtraction, Representation of alphabets.

**UNIT IV:C Programming:**

Problem specification, flow chart, data types, assignment statements,input output statements, developing simple C programs, Ifstatement, for loops, while loops, do-while loops, switch statement,break statement, continue statement.

**UNIT V:Development of C programs using**

Arrays, functions, parameter passing,recursion, Programming in C using these statements, Structures,files, pointers and multi file handling.

**Text / Reference Books**


1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India


**Course Outcomes:**

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

CO1: know and understand the conventions of Fundamentals of Computer.

CO2: represent algorithms through flowchart and pseudo code.

CO3: learn Number system and apply these skills in developing new products.

CO4: understand and learn C Programming.

CO5: Comprehend the Development of C programs using- Arrays, functions.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom's Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | H | M | - | M | L | - | - | - | - | - | L | H | M |
| CO2 | L2 | H | H | M | L | M | L | - | - | - | L | - | L | M | M |
| CO3 | L3 | H | L | M | L | M | L | - | - | - | L | - | L | H | H |
| CO4 | L2 | M | H | L | M | H | - | - | - | - | M | - | M | H | M |
| CO5 | L2 | M | H | H | M | H | - | - | - | - | M | - | M | M | H |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTESC 105A : Basic Electrical Engineering

**Course Objective:**

- To Understand the basic concept of Electrical engineering instruments for engineering applications.
- To Understand the basic electrical engineering parameters and their importance.
- To Understand the concept of various laws and principles associated with electrical systems.
- To Develop the knowledge to apply concepts in the field of electrical engineering, projects and research.

**Detailed contents**

**UNIT I:DC Circuits:**

Electrical circuit elements (R, L and C), voltage and current sources,Kirchhoff current and voltage laws, Series-Parallel circuits, Nodevoltage method, Mesh current method, Superposition, Thevenin's,Norton's and Maximum power transfer theorems.

**UNIT II:AC Circuits:**

Representation of sinusoidal waveforms, peak and r.m.s values,phasor representation, real power, reactive power, apparent power,power factor. Analysis of single-phase AC circuits consisting of R, L,C, RL, RC and RLC combinations (series and parallel), resonance.Three phase balanced circuits, voltage and current relations in starand delta connections.

**UNIT III:Transformers:**

Ideal and practical transformer, EMF equation, equivalent circuit,losses in transformers, regulation and efficiency.

**UNIT IV:Electrical Machines:**

Generation of rotating magnetic fields, Construction and working ofa three-phase induction motor, Significance of torque-slipcharacteristic. Starting and speed control of induction motor, singlephaseinduction motor. Construction, working, torque-speedcharacteristic and speed control of separately excited DC motor.Construction and working of synchronous generators.

**UNIT V:Power Converters:**

Semiconductor PN junction diode and transistor (BJT).Characteristics of SCR, power transistor and IGBT. Basic circuits ofsingle phase rectifier with R load, Single phase Inverter, DC-DCconverter.

**Suggested Text / Reference Books**


1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, " Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.


**Course Outcomes:**

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

**CO1:** Apply basic skills for designing various instruments for engineering applications.

**CO2:** Determine error in laboratory measurements and techniques used to minimize such error.

**CO3:** Gain knowledge regarding the various laws and principles associated with electrical systems.

**CO4:** Understand electrical machines and apply them for practical problems.

**CO5:** Understand the concepts in the field of electrical engineering, projects and research.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | H | M | M | M | - | - | - | - | - | M | - | L | M | M |
| CO2 | L5 | L | M | H | M | L | - | - | - | - | M | - | M | M | M |
| CO3 | L1 | M | H | H | H | - | - | - | - | - | H | - | M | M | M |
| CO4 | L2 | H | L | M | L | - | - | - | - | - | L | - | L | H | M |
| CO5 | L2 | M | H | H | H | - | - | - | - | - | H | - | M | H | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTESC105B: Basic Civil Engineering

**Course Objective:**

- To inculcate the essentials of Civil Engineering field to the students of all branches of Engineering.
- To provide students the significance of the Civil Engineering Profession in satisfying societal needs.

**Detailed contents:**

**Unit I: Introduction to objective, scope and outcome the subject**

**Unit II: Introduction**

Scope and Specialization of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country.

**Unit III: Surveying** Object, Principles & Types of Surveying; Site Plans, Plans& Maps; Scales & Unit of different Measurements. Linear Measurements: Instruments used. Linear Measurement by Tape, Ranging out Survey Lines and overcoming Obstructions; Measurements on sloping ground; Tape corrections, conventional symbols. Angular Measurements: Instruments used; Introduction to Compass Surveying, Bearings and Longitude & Latitude of a Line, Introduction to total station. Levelling : Instrument used, Object of leveling, Methods of leveling in brief, and Contour maps.

**Unit IV: Buildings**

Selection of site for Buildings, Layout of Building Plan, Types of buildings, Plinth area, carpet area, floor space index, Introduction to building byelaws, concept of sun light and ventilation. Components of Buildings & their functions, Basic concept of R.C.C., Introduction to types of foundation.

**Unit V: Transportation**

Introduction to Transportation Engineering; Traffic and Road Safety: Types and Characteristics of Various Modes of Transportation; Various Road Traffic Signs, Causes of Accidents and Road Safety Measures.

**TEXTBOOKS:**


1. Gopi, S., Basic Civil Engineering, Pearson Publishers
2. Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house
3. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
4. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house


**References Books:**


1. Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England
2. Chudley, R. and Greeno, R., Building Construction Handbook, Addison Wesley, Longman Group, England
3. McKay, W. B. and McKay, J. K., Building Construction Volumes 1 to 4, Pearson India Education Services
4. Minu, S., Basic Civil Engineering, Karunya Publications


**Course Outcomes:**

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

**CO1:** Illustrate the fundamental aspects of Civil Engineering.

**CO2:** Understand the scope of civil engineering.

**CO3:** Explain the concepts of surveying for making horizontal and vertical measurements.

**CO4:** Describe plan and set out of a building, also illustrate the uses of various building materials and explains the method of construction of different components of a building.

**CO5:** Understand the modes of Traffic and Road Safety and Road Safety Measures

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | - | - | - | - | M | L | - | - | - | - | M | M | M |
| CO2 | L2 | H | M | M | L | - | M | L | - | - | L | - | L | M | M |
| CO3 | L2 | M | H | M | L | H | - | H | - | - | L | - | L | L | L |
| CO4 | L2 | M | H | M | L | H | - | H | - | - | L | - | L | M | M |
| CO5 | L2 | M | M | L | H | M | L | - | H | - | H | - | H | L | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTBSC106: Engineering Physics Lab

**Course Objective:**

- To understand the concepts of interference.
- To know about wavelength of light.
- To know about depletion layer and band gap of semiconductor.
- To know dispersion of light through prism.
- To know principle of Hall Effect.

**LIST OF EXPERIMENTS :**

1. To determine the wave length of monochromatic light with the help of Michelson's interferometer.
2. To determine the wave length of sodium light by Newton's Ring.
3. To determine the wave length of prominent lines of mercury by plane diffraction grating with the help of spectrometer.
4. Determination of band gap using a P-N junction diode.
5. To determine the height of given object with the help of sextant.
6. To determine the dispersive power of material of a prism with the help of spectrometer.
7. To study the charge and discharge of a condenser and hence determine the same constant both current and voltage graphs are to be plotted.
8. To determine the coherence length and coherence time of laser using He – Ne laser.
9. To measure the numerical aperture of an optical fibre.
10. To study the Hall Effect and determine the Hall Voltage and Hall coefficients.

**Course Outcomes:**

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

CO1: Understand the usage of common Ammeter, voltmeter and Multimeter.

CO2: Formulate and solve complex AC, DC circuits.

CO3: Understand the usage of common electrical measuring instruments.

CO4: Identify the type of electrical machine used for that particular application.

CO5: Understand the usage of optical instruments.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | M | - | H | - | M | - | - | H | - | L | H | L |
| CO2 | L6 | H | H | - | H | - | M | - | - | - | - | - | - | M | M |
| CO3 | L2 | M | L | - | - | L | - | L | - | - | L | - | - | M | L |
| CO4 | L2 | H | M | - | H | M | - | M | L | - | M | - | L | M | M |
| CO5 | L2 | H | M | - | H | M | - | M | L | - | M | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTHSMC107: Language Lab

**Course Objective:**

- To understand concepts of basic English language fundamentals.
- To understand the communication skills.
- To develop Dialogue Writing and Listening comprehension.

**Detailed Syllabus**

1. Phonetic Symbols and Transcriptions.
2. Extempore.
3. Group Discussion.
4. Dialogue Writing.
5. Listening comprehension.

**Course Outcomes:**

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

CO1: understand the Phonetic Symbols and Transcriptions.

CO2: Understand the skills required in Extempore.

CO3: improve their communication skills for Group Discussion.

CO4: improve their technical communication skills.

CO5: Understand Dialogue Writing and Listening skills.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | - | - | - | H | M | - | - | - | H | - | M | H | M |
| CO2 | L2 | M | - | - | - | - | M | - | - | H | H | - | L | M | L |
| CO3 | L6 | M | - | - | - | - | M | - | - | H | H | - | M | M | L |
| CO4 | L6 | M | - | - | - | M | M | - | - | - | H | - | M | M | M |
| CO5 | L2 | M | - | - | - | M | M | - | - | M | H | - | H | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTESC 108: Computer Programming Lab

**Course Objective(s):**

- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

**LIST OF EXPERIMENTS :**

1. To learn about the C Library, Preprocessor directive, Input-outputstatement.
2. Programs to learn data type, variables, If-else statement
3. Programs to understand nested if-else statement and switch statement
4. Programs to learn iterative statements like while and do-while loops
5. Programs to understand for loops for iterative statements
6. Programs to learn about array and string operations
7. Programs to understand sorting and searching using array
8. Programs to learn functions and recursive functions
9. Programs to understand Structure and Union operation
10. Programs to learn Pointer operations
11. Programs to understand File handling operations
12. Programs to input data through Command line argument

**Course Outcomes:**

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

CO1: Learn about the C Library, Preprocessor directive, Input-output statement.

CO2: Learn data type, variables, and conditional statement.

CO3: Learn about array and string operations.

CO4: Understand File handling operations.

CO5: learn programs related to C Programming and apply them to solve real world problems.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | H | - | - | M | L | - | - | - | L | - | L | M | L |
| CO2 | L2 | H | H | M | L | M | L | - | - | - | L | - | L | M | M |
| CO3 | L2 | H | L | M | L | M | L | - | - | - | L | - | L | H | M |
| CO4 | L2 | M | H | L | M | H | L | L | - | - | L | - | M | H | M |
| CO5 | L3 | M | H | H | M | H | M | L | - | - | M | - | M | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTESC 109A: Basic Electrical Engineering Lab

**Course Objectives:**

- To understand training on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood and other metal pieces.
- To develop machining skills in students.

**List of Experiments**

1. Basic safety precautions. Introduction and use of measuring instruments –voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Transformers: Observation of the no-load current waveform on anoscilloscope. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
3. Three-phase transformers: Star and Delta connections. Voltage and Currentrelationships (line-line voltage, phase-to-neutral voltage, line and phasecurrents).Phase-shifts between the primary and secondary side.
4. Demonstration of cut-out sections of machines: dc machine (commutate or brush arrangement), induction machine (squirrel cage rotor), synchronous(field winging - slip ring arrangement) and single-phase induction
5. Torque Speed Characteristic of separately excited dc motor.
6. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d)Components of LT switchgear.

**Course Outcomes:**

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

**CO1.** Adapt knowledge regarding the various laws and principles associated with electrical systems.

**CO2:** Adapt knowledge regarding electrical machines and apply them for practical problems.

**CO3:** Understand various types' Electrical Equipments.

**CO4:** Understanding digital measuring equipments.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | H | M | M | M | M | - | - | - | - | M | - | L | H | M |
| CO2 | L3 | L | M | H | M | M | - | - | - | - | M | - | M | M | M |
| CO3 | L2 | M | H | H | H | M | - | - | - | - | H | - | M | H | H |
| CO4 | L2 | H | L | M | L | M | - | - | - | - | L | - | L | H | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTESC109B: Basic Civil Engineering Lab

**Course Objective(s):**

- To Introduce The Various Activities Regarding Measurement And Leveling
- To Water Supply Procedure And Various Discharge And Pressure Measuring Apparatuses

**LIST OF EXPERIMENTS:**

1. Linear Measurement by Tape:
   a) Ranging and Fixing of Survey Station along straight line and across obstacles.
   b) Laying perpendicular offset along the survey line
2. Compass Survey: Measurement of bearing of linesusing Surveyor's and Prismatic compass
3. Levelling: Using Tilting/ Dumpy/ Automatic Level
   a) To determine the reduced levels in closed circuit.
   b) To carry out profile levelling and plot longitudinal and cross sections for road by Height of Instrument and Rise & Fall Method.
4. To study and take measurements using various electronic surveying instruments like EDM, Total Station etc.
5. To determine pH, hardness and turbidity of the given sample of water.
6. To study various water supply Fittings.
7. To determine the pH and total solids of the given sample of sewage.
8. To study various Sanitary Fittings.

**Course Outcomes:**

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

**CO1:** Conduct survey and collect field data.

**CO2:** Review field notes from survey data.

**CO3:** Interpret survey data and compute areas and volumes.

**CO4:** Describe Total station and measurement

**CO5:** Describe various water fittings and find out the various fluids properties

**Table : Mapping of Course Outcomes with Program Outcomes**

| Course Outcomes | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L4 | H | L | L | L | H | M | L | - | L | L | - | M | H | M |
| CO2 | L2 | H | M | M | M | - | M | L | - | L | M | - | L | M | L |
| CO3 | L4 | M | H | M | H | H | M | H | - | L | H | - | L | L | H |
| CO4 | L2 | M | H | M | H | H | M | H | - | L | H | - | L | - | M |
| CO5 | L2 | M | M | L | H | M | M | - | - | L | H | - | H | L | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTESC110: Computer Aided Engineering Graphics

**Course Objectives:**

- To Increase ability to communicate with people

- To Learn to sketch and take object dimensions.
- To Learn to take data and transform it into graphic drawings.

**Introduction:** Principles of drawing, lines, type of lines, usage of Drawinginstruments, lettering, Conic sections including parabola, hyperbola, RectangularHyperbola (General method only); Scales-Plain, Diagonal and Vernier Scales.

**Projections of Point & Lines:** Position of Point, Notation System, SystematicApproach for projections of points, front view & Top view of point, Position ofstraight lines, line parallel to Both the RPs, Line perpendicular to either of the RPs,Line inclined to one RP and parallel to the other, Line inclined to Both the RPs,Traces of a line (One drawing sheet, one assignment in sketch book).

**Projection of Planes:** Positions of planes, Terms used in projections of planes,plane parallel to RP, plane inclined to one RP and perpendicular to the other RP,plane perpendicular to Both the RPs, plane Inclined to Both the RPs, True shape ofthe plane, Distance of a point from plane, Angle between two planes.

**Projections of Regular Solids:** frustum and truncated solids, those inclined toboth the Planes-Auxiliary Views.

**Section of Solids:** Theory of sectioning, section of prisms and cubes, section ofpyramids and Tetrahedron section of Cylinders, section of cones, section ofspheres (One drawing sheet, one assignment in sketch book)

**Overview of Computer Graphics :** Covering theory of CAD software [such as: Themenu System, Toolbars (standard, Object Properties, Draw, Modify andDimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialogboxes and windows, Shortcut menus (Button Bars), Command Line (whereapplicable), The Status Bar, Different methods of zoom as used in CAD, Select anderase objects.: Isometric Views of lines, Planes, Simple and compound Solids.

**Course Outcomes:**

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

CO1: Know and understand the conventions and the method of engineering drawing.
CO2: Interpret engineering drawings using fundamentals of different views to construct basic and intermediate geometry.
CO3: Know the Theory of sectioning and Section of Solids.
CO4: Comprehend the theory of projection.
CO5: Improve their drawing skill in the form of Computer Graphics.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | L | M | L | L | - | - | L | M | - | L | L | M |
| CO2 | L4 | H | M | L | M | L | L | - | - | - | M | - | L | L | M |
| CO3 | L1 | H | M | L | M | L | L | - | - | L | M | - | L | L | L |
| CO4 | L2 | H | H | M | H | L | L | - | - | L | H | - | M | M | M |
| CO5 | L2 | H | M | M | M | L | L | - | - | L | M | - | M | L | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTCSSODECA 111: Social Outreach, Discipline & Extra Curricular Activities

**Course Objectives:**

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

**Course Outcomes:**

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

**CO1:** Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

**CO2:** Have an impact on academic development, personal development, and civic responsibility

**CO3:** Understand the value of Social Work.

**CO4:** Understand the Significance of Discipline in student's Life

**CO5:** Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P0 11 | PO 12 | PS O1 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | - | - | - | - | - | M | L | M | M | - | - | - | - | - |
| CO2 | L4 | - | - | - | - | - | M | M | M | L | - | - | - | - | - |
| CO3 | L1 | - | - | - | - | - | M | L | M | L | - | - | - | - | - |
| CO4 | L2 | - | - | - | - | - | M | M | M | M | - | - | - | - | - |
| CO5 | L2 | - | - | - | - | - | M | M | L | M | - | - | - | - | - |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## Semester - II

| THEORY PAPERS | | No. of Teaching Hours | | | Marks Allocation | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Subject/Paper** | L | T | P | IA | EA | Total | **Credits** |
| BTBSC 201 | Engineering Mathematics-II | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTBSC 202 | Engineering Chemistry | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTHSMC 203 | Human Values | 2 | - | - | 30 | 70 | 100 | 2 |
| BTESC 204 | Basic Mechanical Engineering | 2 | - | - | 30 | 70 | 100 | 2 |
| BTESC205A/ BTESC205B | Basic Electrical Engineering/ Basic Civil Engineering | 2 | - | - | 30 | 70 | 100 | 2 |
| BTHSMC 206 | Advanced English | 2 | - | - | 30 | 70 | 100 | 2 |
| **PRACTICALS/ VIVA VOCE** | | No. of Teaching Hours | | | Sessional | Practical | Total | Credits |
| BTBSC 207 | Engineering Chemistry Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTHSMC 208 | Human Values Activities | - | - | 2 | 30 | 20 | 50 | 1 |
| BTESC 209 | Manufacturing Practices Workshop | - | - | 2 | 30 | 20 | 50 | 1 |
| BTESC210A/ BTESC 210B | Basic Electrical Engineering Lab/ Basic Civil Engineering Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTESC 211 | Computer Aided Machine Drawing | - | - | 2 | 30 | 20 | 50 | 1 |
| BTSODECA212 | Social Outreach, Discipline & Extra Curricular Activities | - | - | - | - | - | 50 | 1 |
| | **Total** | **14** | **2** | **12** | **330** | **520** | **900** | **22** |

# BTBSC201 : Engineering Mathematics-II

**Course Objective:**

- To provide detailed of **matrices** which is applied for solving system of linear equations and useful in various fields of technology.
- To understand the course is an introduction to ordinary differential equations.
- To understand the collection of methods and techniques used to find solutions to several types of differential equations, including first order scalar equations.

**Unit I: Matrices:**

Rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

**Unit II: First order ordinary differential equations:**

Linear and Bernoulli's equations, Exact equations, Equations not of first degree: equations solvable for *p*, equations solvable for *y*, equations solvable for *x* and Clairaut's type.

**Unit III: Ordinary differential equations of higher orders:**

Linear Differential Equations of Higher order with constant coefficients, Simultaneous Linear Differential Equations, Second order linear differential equations with variable coefficients: Homogenous and Exact forms, one part of CF is known, Change of dependent and independent variables, method of variation of parameters, Cauchy- Euler equation; Power series solutions including Legendre differential equation and Bessel differential equations.

**Unit IV: Partial Differential Equations – First order:**Order and Degree, Formation; Linear Partial differential equations ofFirst order, Lagrange's Form, Non Linear Partial Differential equationsof first order, Charpit's method, Standard forms.

**Unit V: Partial Differential Equations– Higher order :**Classification of Second order partial differential equations, Separation of variables method to simple problems in Cartesian coordinates including two dimensional Laplace, one dimensional Heat and one dimensional Wave equations.

***Textbooks/References:***


1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9$^{th}$Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9$^{th}$Edit ion, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11$^{th}$Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.


**Course Outcomes:**

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

CO1: Understand the matrices, Rank of a matrix, rank-nullity theorem; System of linear equations.

CO2: Identify, analyze and subsequently solve physical situations whose behavior can be described by First order and First degree ordinary differential.

CO3: Determine solutions to second order linear differential equations with variable coefficients.

CO4: Solve Engineering problems using different methods and techniques.

CO5: Evaluate the first order and second order partial differential equations

**Mapping between Objectives and Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | L | M | - | - | - | - | L | M | - | M | M | M |
| CO2 | L4 | M | M | H | M | - | - | - | - | L | M | - | M | M | M |
| CO3 | L4 | H | M | M | M | - | - | - | - | - | M | - | L | M | L |
| CO4 | L6 | H | M | M | M | L | - | - | - | - | M | - | L | L | M |
| CO5 | L5 | H | M | L | M | L | - | - | - | L | M | - | M | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTBSC202 : Engineering Chemistry

**Course Objective:**

- To acquire the knowledge about impurities in water, their determination and purification.
- To learn about different types of fuel and lubricant and their applications.
- To gain the basic knowledge, applications and control methods of corrosion.
- To get the knowledge of preparation and significance of explosives, cement, refractories and glass.
- To get the knowledge of organic reaction mechanism and their uses with different types of drugs

**Detailed contents:**

**Unit I: Water**

Common impurities, hardness, determination of hardness by complexometric (EDTA method), Degree of hardness, Units of hardness Municipal water supply: Requisite of drinking water, Purification of water; sedimentation, filtration, disinfection, breakpoint chlorination. Boiler troubles: Scale and Sludge formation, Internal treatment methods, Priming and Foaming, Boiler corrosion and Caustic embrittlement Water softening; Lime-Soda process, Zeolite (Permutit) process, Demineralization process. Numerical problems based on Hardness, EDTA, Lime-Soda and Zeolite process.

**Unit II: Organic Fuels**

Solid fuels: Coal, Classification of Coal, Proximate and Ultimate analyses of coal and its significance, Gross and Net Calorific value, Determination of Calorific value of coal by Bomb Calorimeter. Metallurgical coke, Carbonization processes; Otto-Hoffmann byproduct oven method. Liquid fuels : Advantages of liquid fuels, Mining, Refining and Composition of petroleum, Cracking, Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number Gaseous fuels; Advantages, manufacturing, composition and Calorific value of coal gas and oil gas, Determination of calorific value of gaseous fuels by Junker's calorimeter Numerical problems based on determination of calorific value (bomb calorimeter/Junkers calorimeter/Dulongs formula, proximate analysis & ultimate and combustion of fuel.

**Unit III: Corrosion and its control**

Definition and significance of corrosion, Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion. Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.

**Unit IV: Engineering Materials**

Portland Cement; Definition, Manufacturing by Rotary kiln. Chemistry of setting and hardening of cement. Role of Gypsum. Glass: Definition, Manufacturing by tank furnace, significance of annealing, Types and properties of soft glass, hard glass, borosilicate glass, glass wool, safety glass Lubricants: Classification, Mechanism, Properties; Viscosity and viscosity index, flash and fire point, cloud and pour point. Emulsification and steam emulsion number.

**Unit V: Organic reaction mechanism and introduction of drugs**

Organic reaction mechanism: Substitution; SN1, SN2, Elecrophilic aromatic substitution in benzene, free radical halogenations of alkanes, Elimination; elimination in alkyl halides, dehydration of alcohols, Addition: electrophilic and free radical addition in alkenes, nucleophilic

addition in aldehyde and ketones, Rearrangement; Carbocation and free radical rearrangements Drugs : Introduction, Synthesis, properties and uses of Aspirin, Paracetamol

**Suggested Text / Reference Books**


1. Morrison R.T & Boyn R. N ; Organic Chemistry; Prentice Hall of India 1999
2. Lee J. D. ; Inorganic Chemistry ;Blackwell Science
3. Gopalan R., Venkappayya D., Nagarajan S. "Engineering Chemistry" Vikas Publishing House Pvt Ltd 2000.
4. Jain & Jain " Engineering Chemistry" Dhanpat Rai publishing company
5. Dara S. S. , " A Text Book of Engineering Chemistry" S. Chand and Company Ltd, 2008
6. Keeler J and Wolhess P, Why Chemical Reaction Happen Oxford Press.


**Course Outcomes:**

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

**CO1:** gain knowledge about impurities in water, their determination and purification.

**CO2:** understand organic fuels and various emerging new areas of organic chemistry.

**CO3:** learn about Corrosion and its control.

**CO4:** Get knowledge about the chemistry of some Engineering Materials like Portland Cement.

**CO5:** understand and study Organic reaction mechanisms.

**Mapping of Course Outcomes onto Program Outcomes**

| Course Outcome | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | - | M | - | - | - | - | - | - | M | - | H | M | M |
| CO2 | L2 | M | - | - | - | L | - | - | - | - | L | - | M | M | M |
| CO3 | L1 | M | - | - | - | - | - | - | - | - | L | - | M | M | L |
| CO4 | L2 | M | - | - | - | - | - | - | - | - | L | - | M | H | M |
| CO5 | L2 | M | - | - | - | - | - | - | - | - | - | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTHSMC203: Human Values

**Course Objective:**

- To Know the basic guidelines, content and Process for Value Education
- To develop understanding different Harmony concept.
- To understand professional ethics and natural acceptance of human values.

**Detailed contents:**

**Unit I: Course Introduction - Need, Basic Guidelines, Content andProcess for Value Education**

Understanding the need, basic guidelines, Self Exploration – itscontent and process; 'Natural Acceptance' and Experiential Validation,Continuous Happiness and Prosperity- Human Aspirations, Rightunderstanding, Relationship and Physical Facilities,UnderstandingHappiness and Prosperity correctly- A critical appraisal of the currentscenario.Method to fulfill the above human aspirations: understanding andliving in harmony at various levels

**Unit II: Understanding Harmony in the Human Being - Harmony in Myself**

Understanding human being as a co-existence of the sentient 'I' andthe material 'Body'Understanding the needs of Self ('I') and 'Body' - Sukh and SuvidhaUnderstanding the Body as an instrument of 'I',Understanding thecharacteristics and activities of 'I' and harmony in 'I' Understandingthe harmony of I with the Body: Sanyam and Swasthya; correctappraisal of Physical needs, meaning of Prosperity in detail, Programsto ensure Sanyam and Swasthya.

**Unit III: Understanding Harmony in the Family and Society- Harmony inHuman-Human Relationship**

Understanding harmony in the Family, Understanding values inhuman-human relationship; meaning of Nyaya and program for itsfulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect(Samman) , meaning of Vishwas; Difference between intention and competence, meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, harmony in the society , Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals ,Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha )- from family to world family.

**Unit IV: Understanding Harmony in the Nature and Existence – Whole existence as Coexistence**

Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in allpervasive Space. Holistic perception of harmony at all levels of existence

**Unit V: Implications of the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values**

Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management

models. Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers. Case studies related to values in professional life and individual life.

**Suggested Text / Reference Books**


1. Gaur R.R., Sangal R. and. Bagaria, G.P: "A Foundation Course in Human Values Professional Ethics," Excel Books, 2010.
2. Sadri S & Sadri, J Business Excellence Through Ethics & Governance, 2ndedition, 2015.
3. Mathur, U C CorporateGovernance and business ethics,MacMillan India Ltd, 2009.
4. Baxi, C V: CorporateGovernance, Excel Books, 2009
5. Sadri S, Sinha A K and Bonnerjee, P: Business Ethics: concepts and cases, TMH, 1998.


**Course Outcomes:**

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

**CO1:** understand and analyze Basic Guidelines, Content and Process for Value Education.

**CO2:** understand Harmony in the Human Being - Harmony in Myself.

**CO3:** Understand Harmony in the Family and Society- Harmony in Human-Human Relationship.

**CO4:** understand Harmony in the Nature and Existence – Whole existence as Coexistence.

**CO5:** Understand of Harmony on Professional Ethics. Natural acceptance of human values.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | - | - | - | - | L | L | M | H | L | M | - | L | M | M |
| CO2 | L2 | - | - | - | - | - | L | M | M | M | M | - | L | M | M |
| CO3 | L2 | - | - | - | - | - | L | M | H | L | M | - | L | M | L |
| CO4 | L2 | - | - | - | - | L | L | L | M | M | L | L | H | M | M |
| CO5 | L2 | L | - | - | - | - | M | M | H | L | M | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTESC 204: Basic Mechanical Engineering

**Course Objectives:**

- To Increase ability to understand machine working
- To Learn to understand fundamentals of mechanical systems
- To Learn to make different mechanical aspects of engineering

**Unit I: Fundamentals:**

Introduction to mechanical engineering, concepts of thermalengineering, mechanical machine design, industrial engineering andmanufacturing technology.Steam Boilers classification and types of steam boilers and steamturbines. Introduction and Classification of power plants.

**Unit II: Pumps and IC Engines:**

Applications and working of Reciprocating and Centrifugal pumps.Introduction, Classification of IC Engines, Main Components of ICEngines, Working of IC Engines and its components.

**Unit III: Refrigeration and Air Conditioning:**

Introduction, classification and types of refrigeration systems andair-conditioning. Applications of refrigeration and Air-conditioning.

**Unit IV: Transmission of Power:**

Introduction and types of Belt and Rope Drives, Gears.

**Unit V:**

Primary Manufacturing Processes:Metal Casting Process: Introduction to Casting Process, Patterns,Molding, Furnaces. Metal Forming Processes: Introduction toForging, Rolling, Extrusion, Drawing. Metal Joining Processes:Introduction to various types of Welding, Gas Cutting, Brazing, andSoldering.

**Course Outcomes:**

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

**CO1:** know and understand the Fundamentals of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology.

**CO2:** understand the Refrigeration and Air Conditioning.

**CO3:** understand the Applications and working of Reciprocating and Centrifugal pumps.

**CO4:** know the Transmission of Power through Belt and Rope Drives, Gears.

**CO5:** understand of Primary Manufacturing Processes.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | L | M | L | - | - | - | - | M | - | L | M | M |
| CO2 | L2 | H | M | L | M | L | - | L | - | - | M | - | L | M | M |
| CO3 | L2 | H | L | L | L | M | - | - | - | - | L | - | L | M | M |
| CO4 | L2 | H | L | L | L | L | - | L | - | - | L | - | L | M | M |
| CO5 | L2 | M | L | L | L | - | - | - | - | - | L | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTESC205A : Basic Electrical Engineering

**Course Objective:**

- To Understand the basic concept of Electrical engineering instruments for engineering applications.
- To Understand the basic electrical engineering parameters and their importance.
- To Understand the concept of various laws and principles associated with electrical systems.
- To Develop the knowledge to apply concepts in the field of electrical engineering, projects and research.

**Detailed contents**

**UNIT I:DC Circuits:**

Electrical circuit elements (R, L and C), voltage and current sources,Kirchhoff current and voltage laws, Series-Parallel circuits, Nodevoltage method, Mesh current method, Superposition, Thevenin's,Norton's and Maximum power transfer theorems.

**UNIT II:AC Circuits:**

Representation of sinusoidal waveforms, peak and r.m.s values,phasor representation, real power, reactive power, apparent power,power factor. Analysis of single-phase AC circuits consisting of R, L,C, RL, RC and RLC combinations (series and parallel), resonance.Three phase balanced circuits, voltage and current relations in starand delta connections.

**UNIT III:Transformers:**

Ideal and practical transformer, EMF equation, equivalent circuit,losses in transformers, regulation and efficiency.

**UNIT IV:Electrical Machines:**

Generation of rotating magnetic fields, Construction and working ofa three-phase induction motor, Significance of torque-slipcharacteristic. Starting and speed control of induction motor, singlephaseinduction motor. Construction, working, torque-speedcharacteristic and speed control of separately excited DC motor.Construction and working of synchronous generators.

**UNIT V:Power Converters:**

Semiconductor PN junction diode and transistor (BJT).Characteristics of SCR, power transistor and IGBT. Basic circuits ofsingle phase rectifier with R load, Single phase Inverter, DC-DCconverter.

**Suggested Text / Reference Books**


**1.** D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, " Fundamentals of Electrical Engineering", Oxford University Press, 2011.
**4.** Hughes, "Electrical and Electronics Technology", Pearson, 2010.
**5.** V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.


**Course Outcomes:**

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

**CO1:** Apply basic skills for designing various instruments for engineering applications.

**CO2:** Determine error in laboratory measurements and techniques used to minimize such error.

**CO3:** Gain knowledge regarding the various laws and principles associated with electrical systems.

**CO4:** Understand electrical machines and apply them for practical problems.

**CO5:** Understand the concepts in the field of electrical engineering, projects and research.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | H | M | M | M | - | - | - | - | - | M | - | L | M | M |
| CO2 | L5 | L | M | H | M | L | - | - | - | - | M | - | M | M | M |
| CO3 | L1 | M | H | H | H | - | - | - | - | - | H | - | M | M | M |
| CO4 | L2 | H | L | M | L | - | - | - | - | - | L | - | L | H | M |
| CO5 | L2 | M | H | H | H | - | - | - | - | - | H | - | M | H | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTESC 205B : Basic Civil Engineering

**Course Objective:**

- To inculcate the essentials of Civil Engineering field to the students of all branches of Engineering.
- To provide students the significance of the Civil Engineering Profession in satisfying societal needs.

**Detailed contents:**

**Unit I: Introduction to objective, scope and outcome the subject**

**Unit II: Introduction**

Scope and Specialization of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country.

**Unit III: Surveying** Object, Principles & Types of Surveying; Site Plans, Plans& Maps; Scales & Unit of different Measurements. Linear Measurements: Instruments used. Linear Measurement by Tape, Ranging out Survey Lines and overcoming Obstructions; Measurements on sloping ground; Tape corrections, conventional symbols. Angular Measurements: Instruments used; Introduction to Compass Surveying,Bearings and Longitude & Latitude of a Line, Introduction to total station. Levelling: Instrument used, Object of leveling, Methods of leveling in brief, and Contour maps.

**Unit IV: Buildings**

Selection of site for Buildings, Layout of Building Plan, Types of buildings, Plinth area, carpet area, floor space index, Introduction to building byelaws, concept of sun light and ventilation. Components of Buildings & their functions, Basic concept of R.C.C., Introduction to types of foundation.

**Unit V: Transportation**

Introduction to Transportation Engineering; Traffic and Road Safety: Types and Characteristics of Various Modes of Transportation; Various Road Traffic Signs, Causes of Accidents and Road Safety Measures.

**TEXTBOOKS:**


5. Gopi, S., Basic Civil Engineering, Pearson Publishers
6. Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house
7. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
8. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house


**References Books:**


5. Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England
6. Chudley, R. and Greeno, R., Building Construction Handbook, Addison Wesley, Longman Group, England
7. McKay, W. B. and McKay, J. K., Building Construction Volumes 1 to 4, Pearson India Education Services
8. Minu, S., Basic Civil Engineering, Karunya Publications


**Course Outcomes:**

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

**CO1:** Illustrate the fundamental aspects of Civil Engineering.

**CO2:** Understand the scope of civil engineering.

**CO3:** Explain the concepts of surveying for making horizontal and vertical measurements.

**CO4:** Describe plan and set out of a building, also illustrate the uses of various building materials and explains the method of construction of different components of a building.

**CO5:** Understand the modes of Traffic and Road Safety and Road Safety Measures

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | - | - | - | - | M | L | - | - | - | - | M | M | M |
| CO2 | L2 | H | M | M | L | - | M | L | - | - | L | - | L | M | M |
| CO3 | L2 | M | H | M | L | H | - | H | - | - | L | - | L | L | L |
| CO4 | L2 | M | H | M | L | H | - | H | - | - | L | - | L | M | M |
| CO5 | L2 | M | M | L | H | M | L | - | H | - | H | - | H | L | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTHSMC206: Advanced English

**Course Objective:**

- To Develop basic communication concept for social environment.
- To Improve conversation skills to increase confidence and proficiency.
- To understand the concept of English in 'real life' situations.
- To apply grammar knowledge for growing according to environment.

**Detailed contents**

**Unit-I (Grammar)**

1. Modal
2. Preposition
3. Conjunction

**Unit-II (Composition)**

1. Resume writing
2. Report writing
3. Advertisement

**Unit-III (Personality)**

1. Define Personality
2. Types of Personality
3. How to develop one's personality

**Unit-IV (Elements of Communication)**

1. Meaning
2. Barriers to communication
3. Functions / Objectives of Communication

**Unit-V (Poems)**

1. 'No men are foreign' – by James Kirk up
2. 'Death, Be not Proud' – by John Donne

**Course Outcomes:**

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

**CO 1:** Understand Communicate in a variety of social, travel and work-related situations
**CO 2:** Understand conversation skills and Widen vocabulary skills
**CO 3:** Apply proficiency in all major skills
**CO 4:** Apply Practice English in 'real life' situations
**CO 5:** Learn how to apply grammar knowledge

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | - | - | - | - | L | M | - | - | - | H | - | M | M | M |
| CO2 | L2 | - | - | - | - | - | H | - | - | - | H | - | - | M | M |
| CO3 | L3 | - | - | - | - | L | - | - | - | M | H | - | M | M | L |
| CO4 | L3 | - | - | - | - | L | H | - | - | - | H | - | - | H | L |
| CO5 | L1 | - | - | - | - | - | H | - | - | - | H | - | - | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTBSC 207: Engineering Chemistry Lab

**Course Objective:**

- To understand the method for the determination of hardness in water and purification process.
- To understand about different types of volumetric analysis.
- To learn about properties of lubricant oil.
- To Synthesize a small drug molecule and analyse a salt sample

**List of Experiments:**

1. Determination the hardness of water by EDTA method
2. Determination of residual chlorine in water
3. Determination of dissolved oxygen in water
4. Determination of the strength of Ferrous Ammonium sulphate solution with the help of K2Cr2O7 solution by using diphenyl amine indicator
5. Determination of the strength of CuSO4 solution iodometrically by using hypo solution
6. Determination of the strength of NaOH and Na2CO3 in a given alkali mixture
7. Proximate analysis of Coal
8. Determination of the flash & fire point and cloud & pour point of lubricating oil
9. Determination of the kinematic viscosity of lubricating oil by Redwood viscometer no. 1 at different temperature
10. Synthesis of Aspirin/ Paracetamol

**Course Outcomes:**

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

**CO1:** Understand the method for the determination of hardness in water and purification process.

**CO2:** understand about different types of volumetric analysis.

**CO3:** learn about properties of lubricant oil.

**CO4:** Synthesize a small drug molecule and analyse a salt sample

**Mapping of Course Outcomes onto Program Outcomes**

| Course Outcome | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | - | M | - | - | L | - | - | M | - | - | M | L |
| CO2 | L1 | L | H | M | H | - | - | L | - | - | H | - | - | M | M |
| CO3 | L1 | M | L | H | L | L | - | M | - | - | L | - | L | M | M |
| CO4 | L3 | L | L | H | L | L | - | L | - | - | L | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTHSM208 : Human Values Activities

**Course Objective:**

- **To Understand the** basic guidelines, content and process for value education.
- To develop understanding different Harmony concept.
- To understand professional ethics and natural acceptance of human values.

## Detailed contents

**PS 1:**

Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your salient achievements and shortcomings in your life? Observe and analyze them.

**PS 2:**

Now-a-days, there is a lot of talk about many technogenic maladies such as energy and material resource depletion, environmental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. - all these seem to be manmadeproblems, threatening the survival of life Earth - What is the root cause of these maladies & what is the way out in opinion? On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression & suicidal attempts etc. - what do you think, is the root cause of these threats to human happiness and peace - what could be the way out in your opinion?

**PS 3:**

1. Observe that each of us has the faculty of 'Natural Acceptance', based on which one can verify what is right or not right for him. (As such we are not properly trained to listen to our 'Natural Acceptance' and may a time it is also clouded by our strong per-conditioning and sensory attractions). Explore the following:
   (i) What is Naturally Acceptable' to you in relationship the feeling of respect or disrespect for yourself and for others?
   (ii) What is 'naturally Acceptable' to you - to nurture or to exploit others? Is your living in accordance with your natural acceptance or different from it?
2. Out of the three basic requirements for fulfillment of your aspirations – right understanding, relationship and physical facilities - observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine.

**PS 4:**

List down all your important desires. Observe whether the desire is related to Self (I) the Body. If it appears to be related to both, visualize which part of it is related to Self (I) and which part is related to Body.

**PS 5:**

1. a. Observe that any physical facility you use, follows the given sequence with time: Necessary and tasteful - unnecessary but still tasteful - unnecessary and tasteless - intolerable
   b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If not acceptable, you want it continuously and if not acceptable, you do not want it any moment!
2. List down all your important activities. Observe whether the activity is of 'I' or of Body or with the participation of both or with the participation of both 'I' and Body.

3. Observe the activities within 'i'. Identify the object of your attention for different moments (over a period of sy 5 to 10 minutes) and draw a line diagram connecting these points. Try observe the link between any two nodes.

**PS 6:**

1. Chalk out some programs towards ensuring your harmony with the body – in terms of nurturing, protection and right utilization of the body.
2. Find out the plants and shrubs growing in and around your campus, which can be useful in curing common diseases.

**PS 7:**

Form small groups in the class and make them carry out a dialogue focusing on the following eight questions related to 'TRUST';

1a. Do I want to make myself happy?

2a. Do I want to make the other happy?

3a. Does the other want to make himself/herself happy?

4a. Does the other want to make me happy?

What is the answer?

Intention (Natural Acceptance)

1b. Am I able to always make myself happy?

2b. Am I able to always make the other happy?

3b. Is the other able to always make himself/herself happy?

What is the answer?

Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate yourself and others on the basis of intention/competence.

**PS 8:**

1. Observe, on how many occasions, you are able to respect your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under-evaluation, over-evaluation or otherwise evaluation.
2. Also, observe whether your feeling of respect is based on treating the other as you would treat yourself or on differentiations based on body, physical facilities or belieds.

**PS 9:**

1. Write a narration in the form of a story, poem, skit or essay to clarify a salient Human Value to the children.
2. Recollect and narrate an incident in your life where you were able to exhibit willful adherence to values in a difficult situation.

**PS 10:**

List down some common units (things) of Nature which you come across in your daily life and classify them in the four orders of Nature. Analysis and explain the aspect of mutual fulfillment of each unit with other orders.

**PS 11:**

Make a chart to show the whole existence as co-existence. With the help of this chart try to identify the role and the scope of some of the courses of your study. Also indicate the areas which are being either over-emphasized or ignored in the present context.

**PS 12:**

Identify any two important problems being faced by the society today and analyze the root cause of these problems. Can these be solved on the basic of natural acceptance of human values. If so, how should one proceed in this direction from the present situation?

**PS 13:**

1. Suggest ways in which you can use your knowledge of Science/Technology/Management etc. for moving towards a universal human order.
2. Propose a broad outline for humanistic Constitution at the level of Nation.

**PS 14:**

The course is going to be over now. It is time to evaluate what difference in your thinking it has made. Summarize the core massage of this course grasped by you. How has this affected you in terms of;

a. Thought
b. Behavior
c. Work and
d. Relization

What practical steps are you able to visualize for the transition of the society from its present state.

**Project:**

Every student required to take-up a social project e.g. educating children in needy/weaker section, services in hospitals, NGO's and other such work i.e. social work at villages adopted by respective institute/ college.

**Course Outcomes:**

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

**CO1:** Analyze Basic Guidelines, Content and Process for Value Education.

**CO2:** Understanding Harmony in the Human Being - Harmony in Myself.

**CO3:** Understand Harmony in the Family and Society- Harmony in Human-Human Relationship. Recollect and narrate an incident in your life.

**CO4:** Understand Harmony in the Nature and Existence – Whole existence as Coexistence. Summarize the core massage of this course grasped by you.

**CO5:** List ac and Implicate the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L4 | - | - | - | - | L | L | M | H | L | M | - | L | M | L |
| CO2 | L2 | - | - | - | - | - | L | M | M | M | M | - | L | M | M |
| CO3 | L2 | - | - | - | - | L | L | M | H | L | M | - | L | M | M |
| CO4 | L2 | - | - | - | - | L | L | L | M | M | L | L | H | M | L |
| CO5 | L1 | - | - | - | - | L | M | M | H | L | M | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTESC 209: Manufacturing Practices Workshop

**Course Objectives:**

- To discuss the modules include training on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood andother metal pieces.
- To develop machining skills in students.

**Carpentry Shop**

1. T – Lap joint
2. Bridle joint

**Foundry Shop**

3. Mould of any pattern
4. Casting of any simple pattern

**Welding Shop**

5. Lap joint by gas welding
6. Butt joint by arc welding
7. Lap joint by arc welding
8. Demonstration of brazing, soldering & gas cutting

**Machine Shop Practice**

9. Job on lathe with one step turning and chamfering operations

**Fitting and Sheet Metal Shop**

10. Finishing of two sides of a square piece by filing
11. Making mechanical joint and soldering of joint on sheet metal
12. To cut a square notch using hacksaw and to drill a hole and tapping

**Course Outcomes:**

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

**CO1:** Describe cast different parts through Carpentry.

**CO2:** Define control manufacturing via computers.

**CO3:** Understanding use power tools and fitting tools.

**CO4:** Knowledge of various welding operations

**CO5:** Understanding different metallic and non-metallic objects.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | L | L | L | L | - | - | - | L | L | - | L | H | M |
| CO2 | L2 | H | M | L | M | M | - | - | - | - | M | - | L | M | L |
| CO3 | L2 | H | M | L | M | M | - | - | - | - | M | - | L | H | M |
| CO4 | L2 | H | M | L | M | M | - | L | - | L | M | - | L | H | M |
| CO5 | L2 | H | M | L | M | M | - | L | - | L | M | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTESC210A Basic Electrical Engineering Lab

**Course Objectives:**

- To understandtraining on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood andother metal pieces.
- To develop machining skills in students.

**List of Experiments**

1. Basic safety precautions. Introduction and use of measuring instruments –voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitorsand inductors.
2. Transformers: Observation of the no-load current waveform on anoscilloscope. Loading of a transformer: measurement of primary andsecondary voltages and currents, and power.
3. Three-phase transformers: Star and Delta connections. Voltage and Currentrelationships (line-line voltage, phase-to-neutral voltage, line and phasecurrents).Phase-shifts between the primary and secondary side.
4. Demonstration of cut-out sections of machines: dc machine (commutate orbrusharrangement), induction machine (squirrel cage rotor), synchronous(field winging - slip ring arrangement) and single-phase induction
5. Torque Speed Characteristic of separately excited dc motor.
6. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d)Components of LT switchgear.

**Course Outcomes:**

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

**CO1.** Adapt knowledge regarding the various laws and principles associated with electrical systems.

**CO2:** Adapt knowledge regarding electrical machines and apply them for practical problems.

**CO3:** Understand various types' Electrical Equipments.

**CO4:** Understanding digital measuring equipments.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | H | M | M | M | M | - | - | - | - | M | - | L | H | M |
| CO2 | L3 | L | M | H | M | M | - | - | - | - | M | - | M | M | M |
| CO3 | L2 | M | H | H | H | M | - | - | - | - | H | - | M | H | H |
| CO4 | L2 | H | L | M | L | M | - | - | - | - | L | - | L | H | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTESC 210B: Basic Civil Engineering Lab

**Course Objective(s):**

- To Introduce The Various Activities Regarding Measurement And Leveling
- To Water Supply Procedure And Various Discharge And Pressure Measuring Apparatuses

**LIST OF EXPERIMENTS:**

1. Linear Measurement by Tape:
   a) Ranging and Fixing of Survey Station along straight line and across obstacles.
   b) Laying perpendicular offset along the survey line
2. Compass Survey: Measurement of bearing of linesusing Surveyor's and Prismatic compass
3. Levelling: Using Tilting/ Dumpy/ Automatic Level
   a) To determine the reduced levels in closed circuit.
   b) To carry out profile levelling and plot longitudinal and cross sections for road by Height of Instrument and Rise & Fall Method.
4. To study and take measurements using various electronic surveying instruments like EDM, Total Station etc.
5. To determine pH, hardness and turbidity of the given sample of water.
6. To study various water supply Fittings.
7. To determine the pH and total solids of the given sample of sewage.
8. To study various Sanitary Fittings.

**Course Outcomes:**

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

**CO1:** Conduct survey and collect field data.

**CO2:** Review field notes from survey data.

**CO3:** Interpret survey data and compute areas and volumes.

**CO4:** Describe Total station and measurement

**CO5:** Describe various water fittings and find out the various fluids properties

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom's Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L4 | H | L | L | L | H | M | L | - | L | L | - | M | H | M |
| CO2 | L2 | H | M | M | M | - | M | L | - | L | M | - | L | M | L |
| CO3 | L4 | M | H | M | H | H | M | H | - | L | H | - | L | L | H |
| CO4 | L2 | M | H | M | H | H | M | H | - | L | H | - | L | - | M |
| CO5 | L2 | M | M | L | H | M | M | - | - | L | H | - | H | L | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTESC 211: Computer Aided Machine Drawing

**Course Objective:**

- To design, develop and analyze simple linear and non linear computer based drawing.
- To identify and apply the suitable knowledge of computers to understand the shape and size of Drawing Objects.

**Syllabus**

**Introduction:** Principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, rules ofdimensioning.

**Conversion of pictorial views into orthographic views:** (1 drawing sheet)Introduction to orthographic prdcojection, concept of first angle and third angleprojection, drawing of simple machine elements in first angle projection, missingview problems covering Principles of Orthographic Projections.

**Sectional views of mechanical components:** (1 drawing sheet) Introduction,cutting plane line, type of sectional views-full section, half section, partial orbroken section, revolved section, removed section, offset section, sectioningconventions-spokes, web rib, shaft, pipes, different types of holes, conventions ofsection lines for different metals and materials.

**Fasteners and other mechanical components:** (Free hand sketch) Temporaryand permanent fasteners, thread nomenclature and forms, thread series,designation, representation of threads, bolted joints, locking arrangement of nuts,screws, washers, foundation bolts etc., keys, types of keys, cotter and knucklejoints. Riveted joints, rivets and riveting, type of rivets, types of riveted joints etc.Bearing: Ball, roller, needle, foot step bearing. Coupling: Protected type, flange, andpin type flexible coupling. Other components: Welded joints, belts and pulleys,pipes and pipe joints, valves etc.

**Overview of Computer Graphics:** (2 drawing sheets) Covering theory of CADsoftware such as: The menu System, Toolbars (Standard, Object Properties, Draw,Modify and Dimension), Drawing Area (Background, Crosshairs, CoordinateSystem), Dialog boxes and windows, Shortcut menus (Button Bars), CommandLine (Where applicable), The Status Bar, Different methods of zoom as used inCAD, Select and erase objects.: Isometric Views of Lines, Planes, Simple andcompound Solids.

**Course Outcomes:**

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

**CO1:** Understand the conventions and the method of engineering drawing.

CO2: Interpret engineering drawings using fundamentals of different views to construct basic and intermediate geometry.

CO3: Adapt theory of sectioning and Section of Solids.

CO4: Classify the theory of projection.

CO5: Understand drawing skill in the form of Computer Graphics.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | L | L | L | L | - | - | - | L | L | - | L | L | M |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO2 | L4 | H | L | H | L | L | - | - | - | - | L | - | L | L | L |
| LCO3 | L3 | H | H | H | H | L | - | - | - | - | H | - | L | L | M |
| CO4 | L4 | H | M | H | M | L | - | - | - | L | M | - | L | M | L |
| CO5 | L2 | H | M | H | M | L | - | - | - | L | M | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTCSSODECA 212: Social Outreach, Discipline & Extra Curricular Activities

**Course Objectives:**

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

**Course Outcomes:**

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

**CO1:** Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

**CO2:** Have an impact on academic development, personal development, and civic responsibility

**CO3:** Understand the value of Social Work.

**CO4:** Understand the Significance of Discipline in student's Life

**CO5:** Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P0 11 | PO 12 | PS O1 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | - | - | - | - | - | M | L | M | M | - | - | - | - | - |
| CO2 | L4 | - | - | - | - | - | M | M | M | L | - | - | - | - | - |
| CO3 | L1 | - | - | - | - | - | M | L | M | L | - | - | - | - | - |
| CO4 | L2 | - | - | - | - | - | M | M | M | M | - | - | - | - | - |
| CO5 | L2 | - | - | - | - | - | M | M | L | M | - | - | - | - | - |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## SEMESTER: III

| THIRD SEMESTER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| THEORY PAPERS | | No. of Teaching Hours | | | Marks Allocation | | | |
| Code | Subject/Paper | L | T | P | IA | EA | Total | Credits |
| BTMEBSC301 | Advance Engineering Mathematics-I | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEHSMC302 | Managerial Economics & Financial Accounting | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEESC303 | Engineering Mechanics | 3 | 1 | 0 | 30 | 70 | 100 | 4 |
| BTMEPCC304 | Engineering Thermodynamics | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEPCC305 | Materials Science and Engineering | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEPCC306 | Mechanics of Solids | 3 | 1 | 0 | 30 | 70 | 100 | 4 |
| | **Sub Total** | **18** | **2** | **0** | **180** | **420** | **600** | **20** |
| **PRACTICALS/VIVA-VOCE** | | **No. of Teaching Hours** | | | **IA** | **EA** | **Total** | **Credits** |
| BTMEPCC307 | Machine drawing practice | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC308 | Materials Testing Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC309 | Basic Mechanical Engineering Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC310 | Programming using MATLAB | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPSIT311 | Industrial Training/ Seminar | - | - | - | 30 | 20 | 50 | 1 |
| BTMESODECA312 | Social Outreach, Discipline & Extra Curricular Activities | | | 0 | 0 | 0 | 50 | 1 |
| | **Sub Total** | | | **8** | **150** | **100** | **300** | **6** |
| **TOTAL** | | **18** | **2** | **8** | **330** | **520** | **900** | **26** |

### BTMEBSC301: Advance Engineering Mathematics-I

**Course Objective:**

1. To Solve probability problems and the transformation.
2. To Differentiate and integrate standard functions of several variables
3. To Define and calculate selected quantities in vector calculus
4. To Formulate and solve engineering optimization problems
5. To Solve second order ordinary differential equations with constant coefficients

## Syllabus

**UNIT 1:Numerical Methods – 1**

Finite differences, Relation between operators,Interpolation using Newton's forward and backward difference formulae. Gauss's forward and backward interpolation formulae. Stirling's Formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange'sformulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

**UNIT 2: Numerical Methods – 2**

Numerical solution of ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge- Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Solution of polynomial and transcendental equations-Bisection method, Newton-Raphson method and Regula-Falsi method

**UNIT3: Laplace Transform**

Definition and existence of Laplace transform, Properties of Laplace Transform and formulae, Unit Step function, Dirac Delta function, Heaviside function, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace transforms method.

**UNIT 4: Fourier Transform**

Fourier Complex, Sine and Cosine transform, properties and formulae, inverse Fourier transforms, Convolution theorem, application of Fourier transforms to partial ordinary differential equation (One dimensional heat and wave equations only).

**UNIT 5: Z-Transform**

Definition, properties and formulae, Convolution theorem, inverse Z-transform, application of Z-transform to difference equation.

**TEXTBOOKS:**

1. Murray R. Spiegel, (1981), "Vector Analysis" Schaum Publishing Co.
2. Grewal B.S. (2006) "Higher Engg. Mathematics", Khanna Publishers, 39th Edition.

**References Books:**

1. Erwin Kre yszig (2006) "AdvanCEd Engg. Mathematics", Wiley Eastern Ltd. 8th Edition
2. Mayar Paul L., (1980), "Introductory Probability and Statistical applications", Addison - Wesley Publishing Company
3. E. G. Nawy, Fundamentals of High-Performance Concrete, John Wiley & Sons Inc., 2nd Ed., 2001.

**COURSE OUTCOMES**

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

CO1 Apply the fundamental concepts of Ordinary Differential Equations and Partial Differential Equations and the basic numerical methods for their resolution.

CO2 Solve the problems choosing the most suitable method.

CO3 Understand the difficulty of solving problems analytically and the need to use numerical approximations for their resolution.

CO4 Use computational tools to solve problems and applications of Ordinary Differential Equations and Partial Differential Equations.

CO5 Compute differential equation problems in the field of Industrial Organisation Engineering.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | M | M | H | M | H | L | - | - | - | M | - | L | H | M |
| CO2 | L3 | M | M | H | M | M | H | L | - | - | M | - | M | M | M |
| CO3 | L2 | H | H | H | H | M | H | - | - | - | H | - | M | H | H |
| CO4 | L3 | H | H | H | H | H | H | L | - | - | H | - | H | H | M |
| CO5 | L3 | M | M | H | M | H | H | - | - | - | M | - | M | M | H |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEHSMC302: Managerial Economics and Financial Accounting

**Course Objective:-**

- To discuss the economic concepts, theories, tools, and methodologies to solve practical problems in a business.
- To provide the student with basic understanding of financial accounting that can be used in decision making techniques.

### Syllabus

**UNIT -1 Basic economic concepts**

Meaning, nature and scope of economics,deductive vs inductive methods, static and dynamics, Economicproblems: scarcity and choice, circular flow of economic activity, nationalincome-concepts and measurement.

**UNIT -2 Demand and Supply analysis**

Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting – purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.

**UNIT- 3 Production and Cost analysis**

Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation

**UNIT -4 Market structure and pricing theory**

Perfect competition, Monopoly, Monopolistic competition, Oligopoly.

**UNIT- 5 Financial statement analysis**

Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash flow analysis, funds-flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.

**Text Books**


1. Managerial Economics and Financial Accounting, M. KASI REDDY, S. SARASWATHI, PHI Learning Pvt. Ltd
2. Managerial Economics and Financial Accounting, Prof. B.K. Garg,Dr. Surabhi Garg, Dr.Kusumlata Bhardwaj , Ashirwad Publication, ISBN- 9788193796207


**Reference Books:**


1. Managerial Economics, R.L.Varshney & K.L Maheswari",. 5th Edition, S.Chand Publishers,
2. Managerial Economics And Financial Analysis, Kumar, P. Vijaya & Rao

**Course Outcomes:**

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

CO1 Understand the conceptual knowledge of accounting

CO2 Sharpen the analytical skills through integrating their knowledge of economic theories with decision making techniques.

CO3 Analyze different market structures and pricing theories.

CO4 Discuss the accounting process and preparation of final accounts of sole trader

CO5 Understand the mechanism of demand and supply.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | - | - | - | - | - | - | - | - | - | L | M | L | M | L |
| CO2 | L3 | - | - | - | - | - | - | - | L | L | - | M | M | M | L |
| CO3 | L4 | - | L | L | - | - | L | - | M | - | L | H | M | H | M |
| CO4 | L5 | - | - | - | - | - | - | - | L | L | - | M | M | L | M |
| CO5 | L2 | - | L | L | - | - | M | - | L | - | - | M | M | M | H |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTMEESC303:Engineering Mechanics

**Course Objectives:**

- To learn a process for analysis of static objects
- To learn concepts of force, moment, and mechanical equilibrium;
- To analyze forces and moments in two and three dimensions;
- To analyze distributed forces and internal loads.
- To analyze forces in various systems such as frames, machines, trusses, beams and cables

## Syllabus

**UNIT 1 Statics of particles and rigid bodies:**

Fundamental laws of mechanics,Principle of transmissibility, System of forces, Resultant force, Resolutionof force, Moment and Couples, Varignon's theorem, Resolution of a forceinto a force and a couple, Free body diagram, Equilibrium, Conditions forequilibrium, Lami's theorem.

**Plane trusses:**

Types of structures, Trusses, Support Conditions, Typesof Loadings, Classification of trusses, Determinacy of trusses, Basicassumptions of truss analysis, Method of joints, Method of sections.Virtual work: Principle of Virtual Work, Active forces and active forcediagram, Stability of equilibrium.

**UNIT 2 Centroid & Moment of inertia**:

Location of centroid and center ofgravity, Moment of inertia, Parallel axis and perpendicular axis theorem,Radius of gyration, M.I of composite section, Polar moment of inertia, M.Iof solid bodies.

**Lifting machines**: Mechanical advantage,

Velocity Ratio, Efficiency ofmachine, Ideal machine, Ideal effort and ideal load, Reversibility ofmachine, Law of machine, Lifting machines; System of pulleys, Simplewheel and axle, Wheel and differential axle, Weston's differential pulleyblock, Worm and worm wheel, Single purchase winch crab, Doublepurchase winch crab, Screw jack, Differential screw jack.

**UNIT 3 Friction**: Types of Friction, Laws of friction, Angle of friction, Angle ofrepose, Ladder, Wedge, Belt Friction.

**Belt and Rope drive**:

Types of belts, Types of belt drives, Velocity ratio,Effect of slip on Velocity ratio, Crowing of pulleys, Length of belt, Ratio oftensions in flat belt drive, Power transmission by belt drives, Advantageand disadvantages of V-Belt over Flat Belt.

**UNIT 4 Kinematics:**

Fundamentals of rectilinear motion and curvilinear motion,applications of general equations, Projectiles motion on plane and oninclined plane, Concept of Relative motion.

**Dynamics:**

Principles of dynamics, D'Alembert's principle, conservationof momentum and energy, Work and Energy and impulse momentummethods, central impact, oblique impact, system of variable mass.

**UNIT 5 Vibrations:**

Introduction to vibrations, Free vibrations of particles,Simple, compound and torsional pendulum, Energy Method.

**Suggested Text / Reference Books**


1. Vector Mechanics for Engineers, Beer and Johnston, Tata McGraw-Hill.
2. Engineering Mechanics, Hibbeler, Pearson Education.
3. Engineering Mechanics, Meriam and Kraige, John Wiley & Sons.
4. Engineering Mechanics, Timoshenko and Young, Tata McGraw-Hill.
5. Engineering Mechanics, Shames, Pearson Education.
6. Engineering Mechanics, Boresi and Schmidt, CL-Engineering.


**Course Outcomes:**

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

CO1: Use a standard process for analyzing static objects

CO2: Define a force and moment

CO3: Apply forces and moments in two and three dimensions, and find a component of a force or moment in a given direction.

CO4: Draw and Construct free body diagrams of an object or a system of connected objects

CO5: Use conditions of equilibrium and known forces and moments to solve for unknown external and internal forces and moments present in an object of system of connected objects

**Table : Mapping of Course Outcomes with Program Outcomes**

| Course Outcome | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L4 | H | M | H | M | H | L | - | - | - | - | - | L | L | M |
| CO2 | L2 | H | M | M | M | - | - | - | - | - | L | - | M | M | M |
| CO3 | L3 | H | H | H | H | - | - | - | - | - | - | - | L | M | H |
| CO4 | L3 | H | H | M | H | H | - | - | - | - | L | - | L | H | L |
| CO5 | L4 | M | M | H | M | L | - | - | - | - | L | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC304: Engineering Thermodynamics

**Course Objectives:**

- To learn about work & heat interactions, balance of energy between system and its surroundings
- To learn about various thermodynamic laws.
- To evaluate the changes in properties of substances in various processes
- To understand the difference between high grade and low grade energies and II law limitations on energy conversion.

### Syllabus

**UNIT 1 Basic Concepts and definitions of Thermodynamics**: System,Surroundings, Property, Energy, Thermodynamic Equilibrium,Process, work and modes of work.

**Zeroth and First Law of Thermodynamics:** Zeroth ofThermodynamics**,** Temperature scale, First law of thermodynamics,First law analysis of some elementary processes. Steady and unsteady flow energy equations.

**UNIT 2 Second Law of Thermodynamics:** Heat engine, Heat pump andrefrigerator, Second law of thermodynamics, Equivalence of theKelvin-Plank and Clausius statements. Reversible and IrreversibleProcesses, Carnot engine, Efficiency of a Carnot engine, Carnotprinciple, thermodynamic temperature scale, Clausis Inequality.

**Entropy**: Entropy, Calculation of Entropy change, Principle of entropyincrease. Temperature-Entropy diagram, Second law analysis of acontrol volume.

**Availability:** Available energy, Loss in available energy, AvailabilityFunction, Irreversibility.

**UNIT 3 Thermodynamic Properties of Fluids:** Pure substance, Concept ofPhase, Graphical representation of p-v-T data, Properties of steam.Steam tables, Mollier chart

**Ideal Gas and Real Gas**: Ideal gas, Real gas, Internal energy, enthalpyand specific heats of an ideal gas, equations of state, Dalton's law ofpartial pressures, Gibbs Dalton law, Thermodynamic properties of gasmixtures.

**UNIT 4 Thermodynamic Relations:** Thermodynamic variables, Independentand dependent variables, Maxwell's thermodynamic relations,Thermodynamic relations involving entropy, Thermodynamic relationsinvolving enthalpy and internal energy, Joule-Thomson coefficient,Clapeyron equation.

**Power Cycles:** Otto cycle, Diesel cycle, Dual cycle, Brayton cycle andEricsson cycle.

**UNIT 5 Vapour power cycle:** Rankine cycle, effect of operating conditions onits efficiency, properties of ideal working fluid in vapour power cycleReheat cycle, regenerative cycle, bleeding extraction cycle, feed waterheating co-generation cycle.

**Suggested Text / Reference Books**

1. Engineering Thermodynamics, Chottopadhyay P., Oxford University Press.
2. Thermal Science & Engineering, Kumar D.S., S.K.Kataria & Sons
3. Engineering Thermodynamics, Nag P.K., Tata McGraw-Hill, New Delhi
4. Fundamentals of Classical Thermodynamics, Gordan J Van Wylen, Willey Eastern Ltd.
5. Engineering Thermodynamics, Cengel & Boles, Tata McGraw-Hill, New Delhi.

**Course Outcomes:**

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

CO1: To Describe about work and heat interactions, and balance of energy between system and its surroundings.

CO2: To learn about application of I law to various energy conversion devices

CO3: To evaluate the changes in properties of substances in various processes

CO4: To understand the difference between high grade and low grade energies and II law limitations on energy conversion

CO5: To examine the condition of steam and performance of vapour power cycle and vapour compression cycle.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | H | M | L | L | - | - | - | - | - | L | M | M |
| CO2 | L2 | H | M | H | M | L | - | L | - | - | - | - | - | M | M |
| CO3 | L5 | H | H | H | H | L | - | - | - | - | - | - | L | M | M |
| CO4 | L2 | H | H | H | H | L | - | L | - | - | - | - | - | M | M |
| CO5 | L4 | M | M | H | M | L | - | - | - | - | - | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC305: Materials Science and Engineering

**Course Objectives:**

- To understand the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
- To provide a detailed interpretation of equilibrium phase diagrams.

### Syllabus

**UNIT 1** Crystal structure – BCC, FCC and HCP, unit cell, crystallographicplanes and directions, miller indices. Crystal imperfections, point,line, surface and volume defects.

Frank Reed source of dislocation, Elastic & plastic modes ofdeformation, Bauschinger's effect, slip & twinning, strain hardening,cold/hot working recovery, re-crystallization and grain growth.

**UNIT 2** Classification of Engineering Materials: Solidification of metals and ofsome typical alloys, mechanism of crystallization (I) nuclear formation(ii) crystal growth, general principles of phase transformation in alloys,phase rule and equilibrium diagrams, equilibrium diagram of binarysystem having complete mutual solubility in liquid state and limitedsolubility in solid state, binary isomorphous alloy system, Hume-Rothery rule , binary system with limited solid solubility of terminalphase and in which solubility decreases with temperature and alsoalloy with a peritectic transformation, equilibrium diagram of a systemwhose components are subject to allotropic change.

Iron carbon equilibrium diagram, phase transformation in the ironcarbon diagram, eutectic, peritectic, eutectoid and peritectoidreactions and microstructures.

**UNIT 3** Isothermal transformation diagrams –cooling curves superimposed onIsothermal Transformation diagram, critical cooling rate. (i) Formationof Austenite from Pearlite (ii) Transformation of Austenite into Pearlite.

Full annealing, stress relief, spheroidizing – normalizing, hardeningand tempering of steel. Hardenability, Jominey end quench test –Austempering, martempering. Case hardening, carburising, nitriding,cyaniding, carbonitriding. Flame and Induction hardening.

**UNIT 4** Non-Metallic Materials- Polymers – types of polymer, commodity andengineering polymers – Properties and applications of PE, PP, PS, PVC,PMMA, PET, PC, PA, ABS, PI, PAI, PPO,PPS, PEEK, PTFE Polymers.Urea and Phenol formaldehydes.

Constitution of alloys: Solid solutions - substitutional and interstitial.Ferrous and Non Ferrous Metals- Effect of alloying additions on steel(Mn, Si, Cr, Mo, V, Ti & W) - stainless and tool steels – HSLA steel.

**UNIT 5** Mechanical Properties and Testing: Types of fracture, testing ofmaterials under tension, compression and shear loads – hardnesstests (Brinell, Vickers and Rockwell) Impact test Izod and charpy,fatigue and creep test.

Classification of steels and cast iron constitution and properties. BISstandards.Engineering Ceramics – Properties and applications of Al2O3, SiC,Si3N4, PSZ etc. Fiber and particulate reinforced composites and resinplastics.Introduction to Nano materials- Nano structured materials. Nanoclusters & Nano crystals.

**Suggested Text / Reference Books:**


1. An Introduction to Material Scince and Engineering, William D.Callister, John Wiley and Sons.
2. Material Science, Raghvan V., Prentice Hall India.
3. Principles of Material Science and Engineering, William F.Smith, McGraw-Hill Publications.
4. Engineering Physical Metallurgy, Lakhtin Y., Mir Publisher.
5. Heat Treatment – Principles and Techniques, Rajan T.V., Sharma and Sharma, Prentice Hall of India.
6. The Structure, Properties and Heat treatment of Metals, Davies D.J. and Oelmann L.A., Pitman Books, London.


**Course Outcomes:**

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

**CO1**. Identify crystal structures for various materials and understand the defects in such structures

**CO2**. Understand material properties of ferrous and non-ferrous alloys

**CO3**. Describe the quantify mechanical integrity and failure in materials

**CO4**. Define the different mechanical properties of material by studying different destructive and non- destructive testing.

**CO5**. Articulate and utilize corrosion prevention strategies and estimate corrosion behavior of materials and components

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | H | M | H | L | - | - | - | L | - | L | M | M |
| CO2 | L2 | H | M | H | M | M | - | - | - | - | L | - | L | M | M |
| CO3 | L2 | H | H | H | H | M | - | - | - | - | L | - | L | L | M |
| CO4 | L1 | H | H | H | H | H | - | - | - | - | L | - | L | L | M |
| CO5 | L3 | M | M | H | M | H | - | - | - | - | L | - | M | L | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC306: Mechanics of Solids

**Objectives:**

- To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads
- To calculate the elastic deformation occurring in various simple geometries for different types of loading

### Syllabus

**UNIT 1 Stress and Strain:** Elementary definition of stress and strain, stressstrainrelationship, elastic, plastic and visco-elastic behavior ofcommon materials in tension and compression test, stress-straincurves, Hooke's law, Poisson's ratio, elastic constants and theirrelations for an isotropic hookean material, anisotropic andorthotropic materials.

Tension, compression, shearing stress and strain, thermal stresses,composite bars, equations of static equilibrium, concept of free bodydiagram. Strain energy due to axial loading.

**UNIT 2 Members Subjected to Flexural Loads:** Theory of simple bending,bending moment and shear force diagrams for different types ofstatic loading and support conditions on beams.bending stresses, section modulus and transverse shear stressdistribution in circular, hollow circular, I, Box, T, angle sections etc.Strain energy due to bending.

**UNIT 3 Principal Planes, Stresses and Strains:** Members subjected tocombined axial, bending and torsional loads, maximum normal andshear stresses, concept of equivalent bending and equivalent twistingmoments, Mohr's circle of stress and strain.

**Theories of Elastic Failures:** The necessity for a theory, differenttheories, significance and comparison, applications.

**UNIT 4 Torsion:** Torsional shear stress in solid, hollow and stepped circularshafts, angular deflection and power transmission capacity. Strainenergy due to torsional loads.

**Stability of Equilibrium:** Instability and elastic stability, long andshort columns, ideal strut, Euler's formula for crippling load forcolumns of different ends, concept of equivalent length, eccentricloading, Rankine formulae and other empirical relations.

**UNIT 5 Transverse Deflection of Beams:** Relation between deflection,bending moment, shear force and load, transverse deflection ofbeams and shaft under static loading, area moment method, directintegration method.

**Thin-walled Pressure Vessels:** Stresses in cylindrical and sphericalvessels

**Suggested Text / Reference Books:**


1. Mechanics of Materials, James M. Gere, Cengage Learning (Brooks\Cole).
2. Mechanics of Material, Pytel and Kiusalaas, Thomson (Brooks\Cole).
3. An Introduction to the Mechanics of Solids, Crandall, Dahl and Lardner, Tata McGraw Hill.
4. Mechanics of Materials, Beer, Johnston, Dewolf and Mazurek, Tata McGraw Hill.
5. Strength of Materials, Ryder G.H., Macmillan India.
6. Strength of Materials, Sadhu Singh, Khanna Publishers.
7. Mechanics of Material, Punmia, Jain and Jain, Laxmi Publications.

**Course Outcomes:**

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

**CO1**: Recognize various types loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components

**CO2:** Evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading

**CO3**: Calculate Shear Force and Bending Moment diagrams for statically determinate beam due to concentrated load, uniformly distributed load, uniformly varying load and couple.

**CO4**: Determine bending and shear stresses in machine elements.

**CO5**: Determine beams subjected to concentrated load, uniformly distributed load, uniformly varying load and couple and also strain energy in members subjected to gradual, sudden and impact loads

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L1 | H | H | H | H | M | - | - | - | - | L | - | L | H | M |
| CO2 | L5 | H | H | H | H | M | - | - | - | - | M | - | M | M | H |
| CO3 | L4 | H | H | H | H | M | - | - | - | - | M | - | M | M | M |
| CO4 | L5 | H | H | H | H | M | - | - | - | - | M | - | H | H | M |
| CO5 | L5 | H | M | H | M | H | - | - | - | - | M | - | M | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC307: Machine Drawing Practice

**Course Objectives:**

- To Increase ability to communicate object drawing details
- Tolearn to sketch and takeobject dimensions.
- To learn to take data and transform it into graphic drawings.
- Tolearn basic engineering drawing formats
- Toprepare the student for future engineering positions

**List of Exercise**

1. Assembly drawing with sectioning and bill of materials of the following: Lathetail stock, shaper tool head, swivel machine vice etc (1 drawing sheet of anyassembly)
2. Detailed part drawings from assembly drawing indicating fits, tolerances andsurface finish symbols by referring BIS codes: Check-valve, Junction Valve etc(1 drawing sheet)
3. Computer Aided Drafting: Introduction to different features of the CADSoftware (AutoCAD/ProE/ Creo/Solidworks). At least one drawing problemrelated to
   a. 2-D Drafting.
   b. 3-D Modeling.
   c. 3-D Advanced Modeling.
   d. Assembly modeling.
   e. Feature Modification and Manipulation
   f. Detailing.
   g. Surface Modeling

**Course Outcomes:**

Upon completion of this course, students will be able:

**CO1:** Understand the conventions and the method of engineering drawing.

**CO2:** Interpret engineering drawings using fundamental technical mathematics.

**CO3:** Improve their visualization skills so that they can apply these skill in developing new products.

**CO4:** Improve their technical skills in understanding engineering drawings.

**CO5:** Comprehend the theory of projection.

**Table : Mapping of Course Outcomes with Program Outcomes**

| Course Outcomes | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | M | L | L | L | L | - | - | - | L | L | - | L | M | L |
| CO2 | L4 | H | L | M | L | L | - | - | - | L | L | - | M | M | M |
| CO3 | L3 | H | L | L | M | L | L | - | - | L | L | - | L | L | L |
| CO4 | L3 | H | L | M | L | L | - | - | - | L | L | - | L | M | H |
| CO5 | L4 | L | L | M | L | M | - | - | - | L | L | - | L | L | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC308: Materials Testing Lab

**Course Objectives:**

- To review physics and chemistry in the context of materials science & engineering.
- To describe the different types of bonding in solids, and the physical ramifications of these differences.

**List of Exercise**

1 Study of various crystals structures through models BCC, FCC, HCP,tetrahedral and octahedral voids.Material identification of, say, 50 common items kept in a box.

2 Specimen preparation for metallographic examination /micro structuralexamination-cutting, grinding, polishing, etching.

3 Comparative study of microstructures of different given specimens (mild steel,gray C.I., brass, copper etc.)

4 Heat treatment experiments such as annealing, normalizing, quenching, casehardening and comparison of hardness before and after.

5 Study of Microstructure and hardness of steel at different rates of cooling.Microstructure examination of white cast iron.

6 To perform Tensile/Compressive/Shear/torsion test on a given material and todetermine its various mechanical properties undertensile/compression/Shear/torsional loading

7 To determine Rockwell/ Vickers/Brinell hardness of a given material

8 To perform Impact test on a given material and to determine its resilience.

9 To study and perform Fatigue test on a given material and to determine fatiguestrength of the material

10 To perform Bending test and to determine the Young's Modulus of Elasticity viadeflection of beam.

11 Creep testing on creep testing machine

**Course Outcomes:**

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

CO1**:** Understand the various crystals structures through models BCC, FCC & HCP

CO2: Understand the basic properties that characterize the behavior of materials

CO3: Understand the type of loadings/environment that materials should withstand

CO4: Select appropriate type of material for specific application

CO5: Apply the different approaches to modify structure/microstructure in order to get desired properties

**Table : Mapping of Course Outcomes with Program Outcomes**

| Course Outcomes | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | M | L | L | L | L | - | - | - | L | L | - | L | M | M |
| CO2 | L2 | H | L | M | L | L | - | - | - | L | L | - | M | L | M |
| CO3 | L2 | H | L | L | L | L | - | - | - | L | L | - | L | M | L |
| CO4 | L1 | H | L | M | L | L | - | - | - | L | L | - | L | L | M |
| CO5 | L3 | M | L | M | L | M | - | - | - | L | L | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC309: Basic Mechanical Engineering Lab

**Course Objectives:**

- To determine hardness of different materials using hardness testing machines.
- To determine strength of materials using testing machine.
- To learn the precautions and steps to operate different machine.

**List of Exercise**

**1** Exposure to a wide range of applications of mechanical engineering through avariety of activities, including hands-on assembly and disassembly ofmachines, such as, bicycle, sewing machine, pumps, engines, air-conditioners,machine-tools, amongst others; observational study of complex systems via cutsections, visits, videos and computer simulations; design of simplemachines/systems including specifications formulation; visits to industries.

**2** Note: Student will be required to submit written report indicating the learningachieved by Hands on assembly/Disassembly.

**Course Outcomes:**

Upon completion of this course, students will be able to:

**CO1:** Understand various pumps.

**CO2:** Understand various tools.

**CO3:** Understand different mechanical systems.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | M | M | L | - | - | - | - | L | - | L | M | M |
| CO2 | L2 | H | M | M | M | - | - | - | - | - | L | - | L | M | M |
| CO3 | L2 | H | M | M | M | - | - | - | - | - | L | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC310: Programming using MATLAB

**Course Objectives:**

- To determine the software skills.
- To learn the programming aspect of matrix lab.

**List of Exercise**

1. Basic functions of MATLAB computer programming
2. Use of formulae and inbuilt functions
3. MATLAB scripts and functions (m-files)
4. Loops and nested loops
5. Array, vector and matrices
6. Plotting functions and vector plots
7. Solving differential equations using MATLAB
8. Reading and writing data, file handling
9. Using MATLAB toolboxes
10. MATLAB graphic functions

**Course Outcomes:**

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

CO1: Understand the main features of the MATLAB development environment

CO2: Use the MATLAB GUI effectively

CO3: Design simple algorithms to solve problems

CO4: Describe simple programs in MATLAB to solve scientific and mathematical problems

**Table : Mapping of Course Outcomes with Program Outcomes**

| Course Outcomes | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | L | L | M | L | - | - | - | - | L | - | L | M | M |
| CO2 | L3 | H | L | L | M | L | - | - | - | - | L | - | M | H | L |
| CO3 | L6 | M | L | M | M | L | - | - | - | - | L | - | M | M | M |
| CO4 | L2 | L | M | M | M | L | - | - | - | - | L | - | L | M | H |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTMEPSIT311: Industrial Training/Seminar

**Course Objectives:**

- To acquire and apply fundamental principles of engineering.
- To update with all the latest changes in technological world.
- To identify, formulate and model problems and find engineering solution based on a systems approach.

**Course Outcomes:**

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

**CO1:** Capability to acquire and apply fundamental principles of engineering.

**CO2:** Become master in one's specialized technology

**CO3:** Become updated with all the latest changes in technological world.

**CO4:** Ability to identify, formulate and model problems and find engineering solution based on a systems approach.

**Table: Mapping of Course Outcomes with Program Outcomes**

| Course Outcome | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P011 | PO 12 | PS O1 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | M | H | L | H | L | - | - | - | - | L | - | L | M | M |
| CO2 | L3 | M | L | H | H | L | - | - | - | - | L | - | M | H | M |
| CO3 | L6 | M | H | M | M | L | - | - | - | - | L | - | M | M | M |
| CO4 | L2 | M | M | M | M | L | - | - | - | - | M | - | L | M | H |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTMESODECA312: Social Outreach, Discipline & Extra Curricular Activities

**Course Objectives:**

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

**Course Outcomes:**

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

**CO1:** Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

**CO2:** Have an impact on academic development, personal development, and civic responsibility

**CO3:** Understand the value of Social Work.

**CO4:** Understand the Significance of Discipline in student's Life

**CO5:** Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P0 11 | PO 12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | - | - | - | - | - | M | L | M | M | - | - | - | - | - |
| CO2 | L4 | - | - | - | - | - | M | M | M | L | - | - | - | - | - |
| CO3 | L1 | - | - | - | - | - | M | L | M | L | - | - | - | - | - |
| CO4 | L2 | - | - | - | - | - | M | M | M | M | - | - | - | - | - |
| CO5 | L2 | - | - | - | - | - | M | M | L | M | - | - | - | - | - |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## SEMESTER IV

| FOURTH SEMESTER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **THEORY PAPERS** | | **No. of Teaching Hours** | | | **Marks Allocation** | | | |
| **Code** | **Subject/Paper** | L | **T** | **P** | **IA** | **EA** | **Total** | **Credits** |
| BTMEBSC401 | Data Analytics | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEHSMC402 | Technical Communications | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEESC403 | Digital Electronics | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTMEPCC404 | Fluid Mechanics & Fluid Machines | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTMEPCC405 | Manufacturing Processes | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTMEPCC406 | Theory Of Machines | 3 | 1 | - | 30 | 70 | 100 | 4 |
| ***PRACTICALS/VIVA-VOCE*** | | **No. of Teaching Hours** | | | **Sessional** | **Practical** | **Total** | **Credits** |
| BTMEPCC407 | **Digital Electronics** Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC408 | Fluid Mechanics Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC409 | Production Practice Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC410 | Theory Of Machine Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMESODECA411 | Social Outreach, Discipline & Extra Curricular Activates | - | - | - | - | - | 50 | 1 |
| **TOTAL** | | 18 | **4** | **8** | **330** | **500** | **850** | **27** |

## BTMEBSC401: Data Analytics

**Course Objective:**

- To understand data retrieval, calculation, interpretation and analysis.
- To gain knowledge of various techniques involved in data estimation.

**Syllabus**

**Unit 1 Introduction:** Objective, scope and outcome of the course. Introduction to Multivariate Statistics-Degree of Relationship among Variables-Review of Univariate and Bivariate Statistics-Screening Data Prior to Analysis-Missing Data, Outliers, Normality, Linearity, and Homoscedasticity.

**Unit 2 Multiple Regression-** Linear and Nonlinear techniques- Backward Forward-Stepwise- Hierarchical regression-Testing interactions (2way interaction) Analysis of Variance and Covariance (ANOVA & ANCOVA)-Multivariate Analysis of Variance and Covariance (MANOVA & MANCOVA).

**Unit 3 Logistic regression:** Regression with binary dependent variable - Simple Discriminant Analysis-Multiple Discriminate analysis Assessing classification accuracy-Conjoint analysis(Full profile method).

**Unit 4 Principal Component Analysis-** Factor Analysis- Orthogonal and Oblique Rotation-Factor Score Estimation-Multidimensional Scaling- Perceptual Map-Cluster Analysis (Hierarchical Vs Nonhierarchical Clustering).

**Unit 5** Latent Variable Models an Introduction to Factor, Path, and Structural Equation Analysis- Time series data analysis (ARIMA model) – Decision tree analysis (CHAID, CART) - Introduction to Big Data Management.

**Suggested Text / Reference Books:**


1. Data Analytics Made Accessible, A. Maheshwari.
2. The Business Case for Big Data, P. Simon.
3. Data Analytics for Beginners: Basic Guide to Master Data Analytics Kindle Edition by Paul Kinley.
4. Data Analytics Basics for Managers (HBR Guide Series) Kindle Edition by Harvard Business.


**Course Outcomes:**

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

CO1: Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.

CO2: Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.

CO3: Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.

CO4: Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc..

**Table: Mapping of Course Outcomes with Program Outcomes**

| Course Outcome | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P01 1 | PO 12 | PS O1 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | M | M | L | - | - | - | - | L | - | L | H | M |
| CO2 | L2 | M | M | L | M | M | - | - | - | - | L | - | L | H | M |
| CO3 | L4 | H | M | L | M | - | - | - | - | - | L | - | L | M | L |
| CO4 | L2 | M | M | M | M | L | - | - | - | - | L | - | L | L | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEHSMC402: Technical Communication

**Course Objectives: -**

- To understand the characteristics of technical writing
- To understandcomplex engineering ideas for targeted audiences.
- To understand the advance technical writing in professional documents.
- To write effective technical and business documents that are grammatically and stylistically correct

**Detailed Contents**

**UNIT1**

**Introduction to Technical Communication-** Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.

**UNIT 2**

**Comprehension of Technical Materials/Texts and Information Design & development-** Reading of technical texts, Reading andcomprehending instructions and technical manuals, Interpreting andsummarizing technical texts, Note-making. Introduction of differentkinds of technical documents, Information collection, factors affectinginformation and document design, Strategies for organization,Information design and writing for print and online media.

**UNIT 3**

**Technical Writing, Grammar and Editing**- Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, Minutes of Meetings.

**UNIT4**

Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals,

**UNIT 5**

**Advanced Technical Writing-** Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.

**Text/Reference Books:**


1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. NewYork, M004
2. M. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, M003. (ISBN 031M406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, M003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, M004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, M004. (ISBN: 078M8357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi M00M.
7. Xebec, Presentation Book, TMH New Delhi, M000. (ISBN 040MM13)

**Course Outcomes:**

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

CO1 Understand basic communication skills used in technical areas.

CO2 Understand technical materials, texts and information design & development.

CO3 Adapt an effective oral presentation, displaying the ability to engage the audience by employing a suitable delivery style, appropriate language and quality visual aids.

CO4 Interpret Technical Reports and its types & features

CO5 Understand the structure and formats of technical articles and proposals

**Table: Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | - | - | - | - | L | L | - | - | L | M | L | H | M | L |
| CO2 | L2 | - | - | - | - | M | L | - | - | L | M | L | H | M | L |
| CO3 | L3 | - | - | - | - | L | L | - | - | L | M | L | H | L | M |
| CO4 | L4 | - | - | - | - | L | L | - | - | L | M | L | H | L | M |
| CO5 | L2 | - | - | - | - | M | L | - | - | L | M | L | M | L | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC403: Digital Electronics

**Objectives:**

- To acquire the basic knowledge of digital logic levels and their application
- To prepare students to perform the analysis and design of various digital electronic circuits.

**Syllabus**

**Unit1Introduction:** Objective, scope and outcome of the course. Semiconductor Devices and Applications: Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.

**Unit2Operational amplifier and its applications:** Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.

**Unit3Timing Circuits and Oscillators:** RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.

**Unit4Digital Electronics Fundamentals:** Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, de-multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.

**Unit5 Electronic Communication Systems:** The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

**Reference/Suggested Books:**


1. T.M. Floyd, R.P. Jain-Digital fundamentals, Pearson Education.
2. Morris and Mano - Digital logic and Computer Design, Prentice – Hall of India
3. R.P. JAIN:Modern Digital Electronics 4/e, TMH.
4. Kharate G K : Digital Electronics, Oxford
5. Pedroni -Digital Electronics & Design , ELSEVIER.
6. Balbir Kumar and Shail B.Jain, “Electronic Devices and Circuits” PHI,


**Course Outcomes:**

Upon completion of this course, students will be:

CO1: Understand different type of codes and number systems which are used in digital transmission and computer systems.

CO2: Apply the codes and number systems converting circuits and Compare different types of logic families which are the basic unit of different types of logic gates in the domain of economy, performance and efficiency.

CO3: Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematical methods.

CO4: Design different types of with and without memory element digital electronic circuits for particular operation, within the real time of economic, performance, efficiency, user friendly and environmental constraints.

CO5: Assess the nomenclature and technology in the area of various memory devices used and apply the memory devices in different types of digital circuits for real world application.

**Table: Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | M | M | L | - | - | - | L | M | - | L | M | M |
| CO2 | L3 | M | L | L | L | M | - | - | - | - | L | - | L | L | H |
| CO3 | L4 | H | L | L | L | - | - | - | - | - | L | - | L | M | M |
| CO4 | L6 | M | M | M | M | - | - | - | - | - | M | - | L | M | H |
| CO5 | L5 | M | L | L | L | M | - | - | - | - | L | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC404: Fluid Mechanics & Fluid Machines

**Course Objectives:**

- To learn about the application of mass and momentum conservation laws for fluid flows
- To understand the importance of dimensional analysis
- To obtain the velocity and pressure variations in various types of simple flows
- To analyze the flow in water pumps and turbines.

**Unit 1 Introduction:** Objective, scope and outcome of the course. Fluid Properties: Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Fluid Statics and Flow Characteristics: Basic equation of fluid statics, Manometers, Force on plane areas and curved surfaces, center of pressure, Buoyant force, Stability of floating and submerged bodies. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

**Unit 2Flow Through Circular Conduits:** Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram-minor losses – Flow through pipes in series and parallel.

**Unit 3 Dimensional Analysis:** Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude – Dimensionless parameters- application of dimensionless parameters – Model analysis.

**Unit 4 Pumps:** Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

**Unit 5 Turbines:** Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

**Reference/Suggested Books:**


1. Fluid Mechanics, Frank M. White, McGraw-Hill Publications.
2. Fluid Mechanics, Cengel and Cimbala, Tata McGraw-Hill, New Delhi.
3. Hydraulics and Fluid Mechanics, Modi and Seth, Standard Book House.
4. Fluid Mechanics, Jain A.K., Khanna Publishers.
5. Introduction to Fluid Mechanics, Fox and McDonald, John Wiley and Sons.

**Course Outcomes:**

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

**CO1:** Mathematically analyze simple flow situations

**CO2:** Evaluate the performance of pumps and turbines.

**CO3:** Use conservation laws in integral form and apply them to determine forces and moments on surfaces of various shapes and simple machines

**CO4:** Use Euler's and Bernoulli's equations and the conservation of mass to determine velocities, pressures, and accelerations for incompressible and in viscid fluids

**CO5:** Design simple pipe systems to deliver fluids under specified conditions.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L4 | H | M | H | M | H | - | - | - | - | L | - | L | M | M |
| CO2 | L5 | H | M | H | M | M | L | L | - | - | L | - | L | M | L |
| CO3 | L3 | H | H | H | H | M | L | L | - | - | L | - | L | M | M |
| CO4 | L3 | H | H | H | H | H | L | L | - | - | L | - | L | H | M |
| CO5 | L6 | M | H | H | M | H | L | L | - | - | L | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC405: Manufacturing Processes

**Course Objectives:**

- To motivate and challenge students to understand and develop processes in correlation with material properties.
- To understand change in the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods.
- To understand the importance of prototyping concept in manufacturing processes

### Syllabus

**Unit 1 Introduction:** Objective, scope and outcome of the course. General Classification and Introduction to Manufacturing processes. Foundry Technology: Casting: Definition and major classification; Casting materials, Patterns: types, material and pattern allowances. Moulding sands; composition, preparation, properties and testing; Grain fineness; moisture content, clay content and permeability test. Core & core prints; Gating system: types, pouring basin, sprue, runner and risers; Melting, pouring and solidification. Principles and method of floor mould casting, shell mould casting, pit mould and loam mould casting;
centrifugalcasting,investment casting; Permanent mould casting. Die casting; Slush casting. Casting defects; types, causes and remedy

**Unit 2 Forming Processes:** Classification; Hot working and cold working; principle, advantages, disadvantages and applications. Forging: Classification, drop forging and press forging methods and use; Forging dies; types, materials. Rolling: Characteristics and applications of hot rolling and cold rolling;

Unit 3 Extrusion: Work materials and products; Press tool works; Basic principles, system, perations and applications. Shearing; Parting, notching, trimming, nibbling, blanking and piercing, Drawing: wire drawing, tube drawing and deep drawing.

**Unit 4 Metal Joining Processes:** Welding, Brazing and soldering, classification of welding process, Principle, characteristics and applications of gas welding, thermit welding, electrical arc welding; Submerged arc welding; TIG and MIG welding; Resistance welding; Spot welding; Butt welding; Seam welding; Projection welding. Principles and process details of Forge welding; Friction welding; Diffusion welding; Ultrasonic welding. Explosive welding. Welding defects; Types, causes, effects and remedy. Electrodes and Electrode Coatings

Unit 5 Powder Metallurgy: Properties of Powder processed materials, Powder manufacturing, mechanical pulverization, sintering, Electrolytic Process, chemical reduction, atomization, properties of metal powders, compacting of powders sintering, advantages and applications of Powder metallurgy.

**Reference/Suggested Books:**


1. Manufacturing Technology, Rao P.N., Tata McGraw-Hill, New Delhi.
2. Manufacturing Engineering and Technology, Kalpkajin, Addison Wesley Publishing Company.
3. Processes and Materials of Manufacture, Lindberg R. A., Prentice Hall of India.
4. Principles of Manufacturing Materials and Processes, Campbell J.S., McGraw Hill

**Course Outcomes:**

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

**CO1-** Select appropriate Manufacturing Processes to produce components.

**CO2-** Interpret foundry practices like pattern making, mold making, Core making and Inspection of defects.

**CO3-** Differentiate various metal forming processes such as Hot and Cold Working, Rolling, Forging, Extrusion and Drawing Processes.

**CO4-** Use different cutting processes .

**CO5-** Select appropriate machine and tools.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L1 | M | M | H | M | H | - | - | - | - | L | - | L | M | L |
| CO2 | L4 | H | M | H | M | M | - | - | - | - | L | - | M | M | M |
| CO3 | L4 | H | M | H | M | M | - | - | - | - | L | - | L | H | L |
| CO4 | L3 | M | H | H | M | H | - | - | - | - | L | - | - | M | M |
| CO5 | L1 | M | H | H | M | H | - | - | - | - | L | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC406: Theory of Machines

**Course Objectives:**

- To understand the kinematics and rigid- body dynamics of kinematically driven machine components
- To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link
- To design some linkage mechanisms and cam systems to generate specified output motion
- To understand the kinematics of gear trains

**Syllabus**

**Unit 1 Introduction:** Objective, scope and outcome of the course. Introduction to mechanism: Basic concept of machines, links, kinematic pair, kinematic chain and mechanism. Inversions of kinematic chains : four bar chain mechanisms, quick return mechanisms, inversions of double slider crank mechanisms. Velocity and acceleration in mechanism: Velocity and acceleration polygons, relative velocity and instantaneous centre method

**Unit 2 Friction devices:** Types and laws of friction. Pivots and collars. Power screws such as lead screw of the lathe. Clutches: Single and multi-plate clutches. Brakes: Band, block and band and block brakes.

**Unit 3 Gears:** Laws of gearing, gears terminology; tooth form; interference, undercutting and minimum number of teeth on pinion. Rack and pinion, Spur, helical, basic introduction of bevel, worm and worm gears. Gear Trains: Simple, compound and epicyclic gear trains.

**Unit 4 Cams:** Type of cams; displacement, velocity and acceleration curves for different cam followers; consideration of pressure angle and wear. Gyroscope: Principles of gyroscopic couple, effect of gyroscopic couple and centrifugal force on vehicles taking a turn, stabilization of ship.

**Unit 5 Balancing:** Balancing of rotating masses in same and different planes, balancing of reciprocating masses, swaying couple, hammer blow and tractive effort.

**Reference/Suggested Books:**


1. Theory of Machines, Rattan S.S., Tata McGraw Hill.
2. Theory of Machines, Thomas Bevan, Pearson Education.
3. Theory of Machines and Mechanisms, Uicker, Pennocle and Shigley, Oxford University Press.
4. Mechanism and Machine Theory, Ambekar A. G., Prentice-hall Of India.
5. Theory of Mechanisms and Machines, Sharma and Purohit, Prentice-hall Of India.
6. Theory of Mechanisms and Machines, Ghosh A., Affiliated East West Press.


**Course Outcomes:**

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

**CO1:** Design various types of linkage mechanisms for obtaining specific motion and analyze them for optimal functioning

**CO2:** Analyze the planar mechanisms for position, velocity and acceleration.

**CO3.** Show the planar four bar and slider crank mechanisms for specified kinematic conditions.

**CO4.** Evaluate gear tooth geometry and select appropriate gears for the required applications.

**CO5.** Understand Cams and followers for specified motion profiles

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L6 | H | M | H | M | M | L | - | - | - | L | - | L | H | M |
| CO2 | L4 | H | M | H | H | M | - | - | - | - | L | - | L | H | M |
| CO3 | L3 | H | L | H | L | M | - | - | - | - | L | - | L | H | M |
| CO4 | L5 | H | M | H | M | M | L | - | - | - | L | - | L | M | H |
| CO5 | L2 | H | M | H | M | M | - | - | - | - | L | - | L | M | H |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC407: Digital Electronics Lab

**Course Objectives:**

- To understand the codes and number systems
- To understand the techniques to prepare the most simplified circuit

**List of Exercise**

1 To verify the truth tables of basic logic gates: AND, OR, NOR, NAND, NOR. Also to verify the truth table of Ex-OR, Ex-NOR (For 2, 3 & 4 inputs using gateswith 2, 3, & 4 inputs).

2 To verify the truth table of OR, AND, NOR, Ex-OR. Ex-NOR realized usingNAND & NOR gates.

3 To realize an SOP and POS expression.

4 To realize Half adder/ Subtractor & Full Adder/ Subtractor using NAND & NOR gates and to verify their truth tables.

5 To realize a 4-bit ripple adder/ Subtractor using basic half adder/ Subtractor& basic Full Adder/ Subtractor.

6 To verify the truth table of 4-to-l multiplexer and l-to-4 demultiplexer. Realize the multiplexer using basic gates only. Also to construct and 8-to-1 multiplexer and l-to-8demultiplexerusing blocks of 4-to-1 multiplexer and 1-to-4 demulriplexer.

7 Design & Realize a combinational circuit that will accept a 2421 BCD code anddrive a TIL - 3 I 2 seven-segment display.

8 Using basic logic gates, realize the R-S, J-K and D-flip flops with and withoutclock signal and verify their truth table.

9 Construct a divide by 2, 4 & 8 asynchronous counter. Construct a 4-bit binarycounter and ring counter for a particular output pattern using D flip flop.

10 Perform input/output operations on parallelin/parallel out and Serialin/Serial out registers using clock. Also exercise loading only one of multiple values into the register using multiplexer.

**Course Outcomes:**

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

CO1: Convert different type of codes and number systems which are used in digital transmission and computer systems.

CO2: Apply the codes and number systems converting circuits and Compare different types of logic families which are the basic unit of different types of logic gates in the domain of economy, performance and efficiency.

CO3: Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematical methods.

CO4: Calculate different types ofdigital electronic circuits with and without memory element for particular operation, within the real time of performance, efficiency, user friendly and environmental constraints.

CO5: Describe the nomenclature and technology in the area of various memory devices used and apply the memory devices in different types of digital circuits for real world application.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | M | M | M | - | - | - | - | L | - | L | L | M |
| CO2 | L3 | H | M | M | M | L | - | - | - | - | L | - | L | M | M |
| CO3 | L4 | H | L | M | L | L | - | - | - | - | L | - | L | L | M |
| CO4 | L4 | H | L | M | L | L | - | - | - | - | L | - | L | M | L |
| CO5 | L2 | H | L | M | L | L | - | - | - | - | L | - | L | L | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTMEPCC408: Fluid Mechanics Lab

**Course Objectives:**

- To understand basic units of measurement, convert units, and their applications
- To discuss the differences among measurement techniques, their relevance and applications

**List of Exercise**

1 Determination of Meta-centric height of a given body.

2 Determination of Cd, Cv & Cc for given orifice.

3 Calibration of contracted Rectangular Notch and / Triangular Notch and determination of flow rate.

4 Determination of velocity of water by Pitot tube.

5 Verification of Bernoulli's theorem.

6 Calibration and flow rate determination using Venturimeter & Orifice meter and Nozzle meter

7 Determination of head loss in given length of pipe.

8 Determination of the Reynold's number for laminar, turbulent and transient flow in pipe.

9 Determination of Coefficient for minor losses in pipes.

10 To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.

11 To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.

12 Conducting experiments and drawing the characteristic curves of centrifugalpump/submergible pump.

13 Conducting experiments and drawing the characteristic curves of reciprocating pump.

14 Conducting experiments and drawing the characteristic curves of Pelton wheel.

15 Conducting experiments and drawing the characteristics curves of Francisturbine.

16 Conducting experiments and drawing the characteristic curves of Kaplanturbine.

**Course Outcomes:**

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

CO1: Identify, name and characterize flow patterns and regimes

CO2: Understand basic units of measurement and conversionof units

CO3: Utilize basic measurement techniques of fluid mechanics

CO4 Discuss the differences among measurement techniques, their relevance and applications

CO5: Measure fluid pressure and relate it to flow velocity

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L1 | H | M | M | M | M | - | - | - | - | L | - | L | M | M |
| CO2 | L2 | H | M | M | H | L | - | - | - | - | L | - | L | L | L |
| CO3 | L3 | H | L | L | L | L | - | - | - | - | L | - | L | M | M |
| CO4 | L2 | M | L | M | L | L | - | - | - | - | L | - | L | L | L |
| CO5 | L3 | M | L | M | L | L | - | - | - | - | L | - | L | L | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC409: Production Practice Lab

**Course Objectives:**

- To acquaint the various conventional manufacturing shop
- To know about the applications of advanced manufacturing processes
- To learn different machine tool in details

**List of Exercise**

**Turning Shop**

1 To study lathe machine construction and various parts including attachments, lathe tools cutting speed, feed and depth of cut.

2 To perform step turning, knurling and chamfering on lathe machine as perdrawing.

3 To cut multi-start Square/Metric threads on lathe machine.

4 Boring using a boring bar in a centre lathe and cut BSW/Metric internal threads on lathe machine.

5 To perform taper turning using compound rest.

**Machine shop**

1 To study the milling machine, milling cutters, indexing heads and indexing methods and to prepare a gear on milling machine.

2 To machine a hexagonal /octagonal nut using indexing head on milling machine.

3 To study of single point cutting tool geometry and to grind the tool as per given tool geometry.

4 To study shaper machine, its mechanism and calculate quick return ratio. Toprepare a job on shaper from given mild steel rod.

5 Cylindrical grinding using grinding attachment in a centre lathe

**Demonstration and study**

1 Demonstration for job by eccentric turning on lathe machine.

2 Study of capstan lathe and its tooling and prepare a tool layout & job as pergiven drawing.

3 Demonstration on milling machine for generation of plane surfaces and use of end milling cutters.

4 Grinding of milling cutters and drills.

**Foundry Shop**

1 To prepare mould of a given pattern requiring core and to cast it in aluminum.

2 To perform moisture test and clay content test.

3 To perform permeability test

4 A.F.S. Sieve analysis test.

5 Strength Test (compressive, Tensile, Shear Transverse etc. in green and dry conditions) and Hardness Test (Mould and Core).

**Welding Shop**

1 Hands-on practice on spot welding

**Course Outcomes:**

Upon completion of this course, students will be able to :

**CO1: Get** knowledge in various metal cutting operations in machine tools like lathe, drilling, milling, grinding, shaping, and planning

**CO2:** Know various machine tools and equipment for manufacturing

**CO3:** Make various types of threads

**CO4:** Understand the concept of patterns.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L1 | H | L | L | L | H | - | - | - | L | L | - | L | M | M |
| CO2 | L1 | H | L | L | L | H | - | - | - | L | L | - | M | M | L |
| CO3 | L3 | M | L | M | L | H | - | - | - | L | L | - | M | M | M |
| CO4 | L2 | H | L | M | M | L | - | - | - | L | L | - | L | L | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC410: Theory of Machine Lab

**Course Objectives:**

- To determine the balancing of masses of rotating and reciprocating machine elements.
- To understand the principles of gyroscope and governors
- To understand working of brakes and dynamometer
- To determine the moment of inertia of various mechanical systems.

**List of Exercise**

1. To study inversions of four bar chain and slider crank mechanism and their practical applications.
2. To study Steering Mechanisms: Davis and Ackerman.
3. Study of quick return mechanism and its practical applications.
4. Study of inversion of Double slider chain: Oldham Coupling, Scotch Yoke andElliptical Trammel.
5. Study of various cam-follower arrangements. To plot displacement v/s angle of rotation curve for various cams
6. To determine co-efficient of friction using two roller oscillating arrangement.
7. Study of various types of dynamometers, Brakes and Clutches.
8. Study of differential gear box.
9. To verify the torque relation for gyroscope.
10. To perform wheel balancing. To perform static and dynamic balancing on balancing set up.
11. Study of a lathe gear box, sliding mesh automobile gear box, planetary gear box.

**Course Outcomes:**

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

**CO1:** Apply the principles of balancing of masses to various links, mechanisms and engines.

**CO2.** Apply the principles of gyroscopic effects and stabilization on various transport vehicles and applications of various governors.

**CO3**. Understand the working principles of brakes and dynamometer.

**CO4.** Determine moment of inertia of mechanical systems.

**CO5**. Determine the vibration parameters of different systems.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | H | L | M | L | M | L | - | - | L | L | - | L | L | M |
| CO2 | L3 | H | L | M | L | M | L | - | - | - | L | - | L | M | M |
| CO3 | L2 | H | L | M | L | M | L | - | - | - | L | - | L | L | M |
| CO4 | L5 | H | L | M | L | M | - | - | - | L | L | - | L | M | H |
| CO5 | L5 | H | L | M | L | M | L | - | - | L | L | - | L | H | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTCSSODECA 412: Social Outreach, Discipline & Extra Curricular Activities

**Course Objectives:**

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

**Course Outcomes:**

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

**CO1:** Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

**CO2:** Have an impact on academic development, personal development, and civic responsibility

**CO3:** Understand the value of Social Work.

**CO4:** Understand the Significance of Discipline in student's Life

**CO5:** Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P0 11 | PO 12 | PS O1 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | - | - | - | - | - | M | L | M | M | - | - | - | - | - |
| CO2 | L4 | - | - | - | - | - | M | M | M | L | - | - | - | - | - |
| CO3 | L1 | - | - | - | - | - | M | L | M | L | - | - | - | - | - |
| CO4 | L2 | - | - | - | - | - | M | M | M | M | - | - | - | - | - |
| CO5 | L2 | - | - | - | - | - | M | M | L | M | - | - | - | - | - |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# Semester V

| BACHELOR OF TECHNOLOGY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| MECHANICAL ENGINEERING | | | | | | | | |
| FIFTH SEMESTER | | | | | | | | |
| **THEORY PAPERS** | | **No. of Teaching Hours** | | | **Marks Allocation** | | | |
| **Code** | **Subject/Paper** | L | **T** | **P** | **IA** | **EA** | **Total** | **Credits** |
| **BTMEPCC501** | **Mechatronics Systems** | 3 | - | - | 30 | 70 | 100 | 4 |
| BTMEPCC502 | Heat Transfer | 3 | 1 | - | 30 | 70 | 100 | 3 |
| BTMEPCC503 | Manufacturing Technology | 3 | - | - | 30 | 70 | 100 | 4 |
| BTMEPCC504 | Design Of Machine Elements I | 3 | 1 | - | 30 | 70 | 100 | 3 |
| BTMEPCC505 | Principles Of Management | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEPCC506.A | Steam Engineering | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEPCC506.B | Automobile Engineering | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEPCC506.C | Non Destructive Evaluation & Testing | 3 | - | - | 30 | 70 | 100 | 3 |
| ***PRACTICALS/VIVA-VOCE*** | | **No. of Teaching Hours** | | | **Sessional** | **Practical** | **Total** | **Credits** |
| BTMEPCC507 | Mechatronics Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC508 | Heat Transfer Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC509 | Production Engineering Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC510 | Machine Design Practice Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPSIT511 | Industrial Training/ Seminar | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMESODECA512 | Social Outreach, Discipline & Extra Curricular Activities | - | - | - | - | - | 50 | 1 |
| **TOTAL** | | 18 | **2** | **10** | **330** | **520** | **900** | **26** |

## BTMEPCC501: Mechatronics Systems

**Course Objectives:**

- To understand the structure of microprocessors and their applications in mechanical device
- To understand the principle of automatic control and real time motion control systems, with the help of electrical drives and actuators
- To understand the use of micro-sensors and their applications in various fields

**Syllabus**

**Unit 1.** Introduction: Objective, scope and outcome of the course. Overview of Mechatronics: Historical perspective, Definition, Applications, Block diagram of Mechatronic system, Functions of Mechatronics Systems, Systems Engineering, Verification Vs Validation, Benefits of mechatronics in manufacturing. Electrical and Electronic Systems: Electrical circuits and Kirchhoff's laws, Network Theorems and AC circuit Analysis, Transformers, Analog Devices, Signal Conditioning, Digital Electronics, Data Acquisition systems.

**Unit2.** Modeling, Analysis and Control of Physical Systems: Basics of System Modeling: LTI and LTV systems, Need for modeling, Types of modeling, Steps in modeling, Building blocks of models, Modelling of one and two degrees of freedom systems, Modeling of Electromechanical systems, Mechanical Systems, Fluid systems, Thermal systems; Dynamic Responses, System Transfer Functions, State Space Analysis and System Properties, Stability Analysis using Root Locus Method, Stability Analysis using Bode Plots, PID Controllers (with and without Time Delay)

**Unit 3.** Sensors and Actuators: Static characteristics of sensors and actuators, Position, Displacement and Proximity Sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level sensors, Light sensors, Smart material sensors, Micro and Nano sensors, Selection criteria for sensors, Actuators: Electrical Actuators (Solenoids, Relays, Diodes, Thyristors, Triacs, BJT, FET, DC motor, Servo motor, BLDC motor, AC motor, Stepper motors), Hydraulic and Pneumatic actuators, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys.

**Unit 4.** Microprocessors, Microcontrollers and Programmable Logic Controllers: Logic Concepts and Design, System Interfaces, Communication and Computer Networks, Fault Analysis in Mechatronic Systems, Synchronous and Asynchronous Sequential Systems, Architecture, Microcontrollers.

**Unit 5**. Programmable Logic Controllers (PLCs): Architecture, Number Systems Basics of PLC Programming, Logics, Timers and Counters, Application on real time industrial automation systems.Case Studies: Design of pick and place robot, Car engine management system, Automated manufacturing system, Automatic camera, Automatic parking system, Safety devices and systems.

**Suggested Text / Reference Books:**


1. D. Shetty & R. Kolk, Mechatronics System Design, PWS Publishers
2. Mechatronics – HMT, Tata McGraw Hill Publishing Company Ltd.
3. Aditya P. Mathur, Introduction to Microprocessors, Tata McGraw Hill.
4. C. R. Venkataramana, Mechatronics, Sapna Book house, Bangalore.

**Course Outcomes:**

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

**CO1:** Identifythe key elements of Mechatronics system, representation into block diagram

**CO2**: Apply knowledge of the concept of signal processing and signal conditioning for its industrial applications

**CO3:**Analyze the requirements for a given industrial process and select the most appropriate Actuators, sensors, design circuit according to applications

**CO4:** Understand the different logic gates, architecture of microprocessor and microcontroller for industrial applications.

**CO5:** Develop mechatronics system according to an Industrial Applications

**Table: Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L1 | M | M | M | M | H | - | - | - | - | M | - | L | M | M |
| CO2 | L3 | M | M | L | M | M | - | - | - | - | M | - | L | H | M |
| CO3 | L4 | H | H | L | H | M | - | - | - | - | H | - | L | M | L |
| CO4 | L2 | H | L | H | L | M | - | - | - | - | L | - | L | L | M |
| CO5 | L6 | M | M | M | M | H | - | - | - | - | M | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC502: Heat Transfer

**Course Objectives:**

- To build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation.
- Tostudy rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations.

**Syllabus**

**Unit1.** Introduction: Objective, scope and outcome of the course. Introduction: Heat transfer processes, conduction and radiation. Fourier's law of heat conduction, thermal conductivity, thermal conductivity of solids, liquids and gases, effect of temperature on thermal conductivity. Newton's law of cooling, definition of overall heat transfer coefficient. General parameters influence the value of heat transfer coefficient. Conduction: General 3-Dimensoinal conduction equation in Cartesian, cylindrical and spherical coordinates; different kinds of boundary conditions; nature of differential equations; one dimensional heat conduction with and without heat generation; electrical analogy; heat conduction through composite walls; critical thickness of insulation.

**Unit 2.** Heat transfer from extended surfaces: Governing differential equation of fin, fin efficiency and effectiveness for different boundary conditions. Unsteady state heat conduction for slab, cylinder and sphere, Heisler chart. Convection: Review of Navier – Stokes and energy equation, hydrodynamic and thermal boundary layers; laminar boundary layer equations; forced convection appropriate non dimensional members; effect of Prandtl number; empirical relations for flow over a flat plate and flow through pipes.

**Unit 3.** Natural convection: Dimensional analysis, Grashoff number, boundary layers in external flows (flow over a flat plate only), boundary layer equations and their solutions, heat transfer correlations.Heat transfer with change of phase: Nature of vaporization phenomena; different regimes of boiling heat transfer; correlations for saturated liquid vaporization; condensation on flat plates; correlation of experimental results, drop wise condensation.

**Unit 4.** Heat exchanger: Types of heat exchangers, arithmetic and logarithmic mean temperature differences, heat transfer coefficient for parallel, counter and cross flow type heat exchanger; effectiveness of heat exchanger, N.T.U. method, fouling factor. Constructional and manufacturing aspects of Heat Exchangers.

**Unit 5.** Thermal Radiation: Plank distribution law, Krichoff's law; radiation properties, diffuse radiations; Lambert's law. Radiation intensity, heat exchange between two black bodies heat exchanger between gray bodies. Shape factor; electrical analogy; reradiating surfaces heat transfer in presence of reradiating surfaces.

**Suggested Text / Reference Books:**


1. Heat Transfer, Holman J.P., Tata McGraw-Hill, New Delhi.
2. Heat and Mass Transfer, Cengel, Tata McGraw-Hill, New Delhi.
3. Heat and Mass Transfer, Kumar D.S., Kataria and Sons.
4. Heat Transfer, Sharma and Lal, Vardhan Publisher Jaipur.
5. Heat and Mass Transfer, Nag P.K., Tata McGraw-Hill, New Delhi.
6. Fundamental of Heat and Mass Transfer, Thirumaleshwar M., Pearson Education.
7. Heat Transfer, Rajput R.K., S. Chand Publication.


**Course Outcomes:**

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

**CO1**.Formulate and analyze a heat transfer problem involving any of the three modes of heat transfer

**CO2**. Obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer

**CO3.**Design devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary.

**CO4.** Calculate and execute the impact of boundary conditions on the solutions of heat transfer in conduction and convection problems like extended surfaces (Fins)

**CO5**-Determine performance of thermal systems related to one dimension, steady state natural and Forced Convection heat transfer by theoretically and experimentally.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L4,L6 | H | M | H | M | L | - | L | - | L | M | - | L | M | L |
| CO2 | L4 | H | M | H | M | L | - | L | - | - | M | - | L | M | M |
| CO3 | L6 | H | M | H | M | L | - | - | - | - | M | - | L | L | M |
| CO4 | L3 | H | H | H | H | L | - | L | - | - | H | - | L | M | L |
| CO5 | L5 | H | M | H | M | L | - | - | - | - | M | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC503: Manufacturing Technology

**Course Objectives:**

- To provide knowledge on machines and related tools for manufacturing various components.
- To understand the relationship between process and system in manufacturing domain.
- To identify the techniques for the quality assurance of the products and the optimality of the process in terms of resources and time management.

**Syllabus**

**Unit1.** Introduction: Objective, scope and outcome of the course. Classification of metal removal process and machines: Geometry of single point cutting tool and tool angles, tool nomenclature in ASA, ORS. Concept of orthogonal and oblique cutting. Type of chips, Mechanics of metal cutting; interrelationships between cutting force, shear angle, strain and strain rate. Thermal aspects of machining and measurement of chip tool interface temperature.

**Unit 2.** Concept of machinability, machinability index, factors affecting machinability, Different mechanism of tool wear. Types of tool wear (crater, flank etc), Concept of tool life. Taylor's tool life equation. Introduction to economics of machining. Cutting fluids: Types, properties, selection and application methods

**Unit 3.** Basic machine tools: Constructional configuration, estimation of machining time on lathe, drilling, shaping, milling, grinding, Gear cutting on milling, Gear hobbling. Special Purpose Machine Tools: Automatic lathes, capstan and turret lathe machines, operational planning and turret tool layout, sequence of operations.

**Unit 4.** Introduction to Grinding and different methods of grinding, Abrasives; natural and synthetic, manufacturing and selection of grinding wheels, Wheel specifications. Honing, lapping, superfinishing.

**Unit 5.** High Velocity Forming Methods: Definition; Hydraulic forming, Explosive forming, Electro-hydraulic forming, Magnetic pulse forming.

**Suggested Text / Reference Books:**


1. Manufacturing Science, Ghosh and Mallik, Tata McGraw-Hill
2. Manufacturing Technology II, Rao P.N., Tata McGraw-Hill
3. Production Technology, Jain R.K., Khanna Publisher.
4. Production Technology, HMT Banglore, Tata McGraw-Hill
5. Mechanical Measurement and Metrology, Jain R.K., Khanna Publisher.
6. Metal Cutting Principles, Shaw M.C., Oxford
7. Manufacturing Tool Design, Mehta N.K., Tata McGraw Hill.


**Course Outcomes:**

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

CO1: learn the tooling needed for manufacturing,

CO2: Understand the dimensional accuracy.

CO3: Apply tolerances in products.

CO4: Analyze assembly of different components.

CO5: Understand application of optimization methods in manufacturing.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L1 | M | M | H | M | H | L | - | - | - | M | - | L | L | H |
| CO2 | L2 | H | M | H | M | M | - | - | - | - | M | - | L | M | M |
| CO3 | L3 | H | M | H | M | M | - | - | - | - | M | - | L | L | L |
| CO4 | L4 | H | M | H | M | H | - | - | - | - | M | - | L | M | H |
| CO5 | L2 | H | M | H | M | H | - | - | - | - | M | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC504: Design of Machine Elements-I

**Course Objectives:**

- To understand the origins, nature and applicability of empirical design principles, based on safety considerations
- To understand the codes, standards and design guidelines for different elements

**Syllabus**

**Unit 1** Introduction: Objective, scope and outcome of the course. Materials: Mechanical Properties and IS coding of various materials, Selection of material from properties and economic aspects.

**Unit 2** Manufacturing Considerations in Design: Standardization, Interchangeability, limits, fits tolerances and surface roughness, BIS codes, Design consideration for cast, forged and machined parts. Design for assembly. Design for Strength: Modes of failure, Strength and Stiffness considerations, Allowable stresses, factor of safety, Stress concentration: causes and mitigation, fatigue failures.

**Unit 3** Design of Members subjected to direct stress: pin, cotter and keyed joints. Design of Members in Bending: Beams, levers and laminated springs. Design for stiffness of beam: Use of maximum deflection formula for various end conditions for beam design

**Unit 4** Design of Members in Torsion Shaft and Keys: Design for strength, rigidity. Solid and hollow shafts. Shafts under combined loading. Sunk keys. Couplings: Design of muff coupling, flanged couplings: rigid and flexible

**Unit 5** Design of Threaded fasteners: Bolt of uniform strength, Preloading of bolts: Effect of initial tension and applied loads, Eccentric loading Power screws like lead screw, screw jack Design of members which are curved like crane hook, body of clamp, machine frame etc.

**Suggested Text / Reference Books:**


1. Mechanical Machine Design, Bahl and Goel, Standard Publishers Distributors.
2. Design of Machine Elements, Bhandari V.B, Tata McGraw-Hill, New Delhi.
3. Machine Design, Sharma and Aggarwal, S.K.Kataria and Sons, Delhi.
4. Mechanical Engg Design, Shigley, Mischke, Budynas and Nisbett, Tata McGraw-Hill.
5. Design of Machine Elements, Sharma and Purohit, Prentice Hall India.
6. Machine Design, Kulkarni S. G., Tata McGraw Hill
7. A Text Book of Machine Design, Karwa A., Laxmi Publications.
8. Machine Design, Hall, Holwenko and Laughlin, Schaum's Outlines Series, Tata McGraw Hill.


**Course Outcomes:**

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

**CO1**: Recognize the design methodologies employed for the design of various machine components.

**CO2:**Apply knowledge of the stress and strain of mechanical components

**CO3**: Develop Logical and Analytical ability to apply Knowledge of various theories of failures for design of Mechanical components use in Industries

**CO4:**Understand the mechanism of fatigue failures of parts and its use in mechanical component design.

**CO5**: Understand different welded and riveted joints structure and able to apply its knowledge to analyze its strength when subjected to simple, coplanar and eccentric loading.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | H | H | H | H | - | - | - | - | H | - | L | M | H |
| CO2 | L3 | H | M | H | M | M | - | - | - | - | M | - | L | M | M |
| CO3 | L6 | H | H | H | H | M | - | - | - | - | H | - | L | H | M |
| CO4 | L2 | H | H | H | H | M | - | - | - | - | H | - | L | M | M |
| CO5 | L2 | H | M | H | M | M | - | - | - | - | M | - | L | L | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC505: Principles of Management

**Course Objectives:**

- To understand the principles of management and their application to the functioning of an Organization
- To provide them tools and techniques to be used in the performance of the managerial job.
- To enable them to analyze and understand the environment of the organization.

**Syllabus**

**Unit 1** Introduction: Objective, scope and outcome of the course. Basic concepts of management: Definition – Need and Scope – Different schools of management thought – Behavioural, Scientific, Systems, and Contingency Contribution of Management Thinkers: Kautilya, Taylor, Fayol, Peter Drucker and C.K. Prahlad.

**Unit 2** Functions of Management: Planning: Essentials of Planning and Managing by Objectives; Strategies, Policies and Planning Premises; Decision making.Organizing The Nature of organizing, Entrepreneuring, and Reengineering; Organizational Structure, Departmentation; Line/staff authority, empowerment, and decentralization; Effective organizing and organization culture;

**Unit 3** Staffing Human resource Management and Selection; Performance Appraisal and Career Strategy; managing change through Manager and Organization Development.

**Unit 4**Leading Human Factors and Motivation; Leadership: Committees, Terms, and Group Decision making; Communication. Controlling The system and process of controlling; Control Techniques and Information Technology; Productivity, Operations Management and Total Quality Management.

**Unit 5** Management practices of: Dhirubhai Ambani, Narayan Murthy, Premji, Ratan Tata, Steve Jobs, Bill Gates. Studying organizational structures of any 10 companies and classifying them into different types of organizations which are studied above and justifying why such structures are chosen by those organizations. Preparing the leadership profiles of any 5 business leaders and studying their leadership qualities.

**Suggested Text / Reference Books:**


1. Works Organisation and Management, Basu S.K., Sahu K.C., Datta N.K., Oxford and IBH.
2. Principles of Industrial Organization, Dexter S. Kimball, Read Books.
3. Principles of Industrial Management, Alford and Beatty, Revised Edition, Ronald Press Co.
4. Essentials of Industrial Management, McGraw-Hill industrial organization and management series, Lawrence L. Bethel, McGraw-Hill.
5. Engineering Economics, Riggs, Tata McGraw-Hill


**Course Outcomes:**

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

**CO1:** Understand the concepts related to Business.

**CO2:** Demonstrate the roles, skills and functions of management.

**CO3:** Analyze effective application of PPM knowledge to diagnose and solve organizational problems and develop optimal managerial decisions.

**CO4:** Understand the complexities associated with management of human resources in the organizations and integrate the learning in handling these complexities.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | - | - | - | - | - | L | - | - | M | L | L | L | M | M |
| CO2 | L3 | - | - | - | - | - | M | - | - | M | L | L | L | H | M |
| CO3 | L4 | L | L | L | L | - | M | - | - | M | L | M | L | M | H |
| CO4 | L2 | - | - | L | - | - | M | - | - | M | L | M | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPEC506.A: Steam Engineering

**Course Objectives:**

- To understand the construction of various parts of steam plants.
- To understand the working principle of various parts steam generation

**Syllabus**

Unit 1 Introduction: Objective, scope and outcome of the course. Steam generators: Classification of Boilers, water and fire tube boilers, High pressure boilers, Advantages of high pressure Boilers, Natural and forced circulation boilers, Water wall. Steam drum internal, steam super heaters, Economizers, air preheater, induced, forced and balanced draught boilers, Fluidized bed boilers

Unit 2 Definition and type of nozzle and diffuser equation of continuity, sonic velocity, mach no. and stagnation properties, the steady flow energy equation for nozzles, momentum energy equation for flow through steam nozzles nozzle efficiency, effect of friction, nozzle for uniform pressure drop, throat pressure for maximum discharge or chock flow, critical pressure ratio, design of nozzle and diffuser.

Unit 3 Steam Turbines: Principle and working of steam turbines, type of turbines, compounding for pressure and velocity. Overview and difference of various type of turbine, different types of governing of turbines. Impulse turbine: The effect of blade friction on velocity diagram. Force, work and power, Blade or diagram efficiency, Gross stage efficiency, steam speed to blade, speed ratio for optimum performance, turbine performance at various loads

Unit 4 Impulse reaction turbine: Velocity diagram and work done, degree of reaction, Parson turbine, blade efficiency, gross stage efficiency comparison of enthalpy drop in various stages, size of blades in impulse reaction turbines for various stages of impulse reaction and impulse turbine. Regenerative Feed Heating Cycles: Introduction, Ideal regenerative feed heating cycle, Regenerative heating cycles and their representation on T-s and h-s Diagram, Representation of actual process on T-s and h-s Diagram Regenerative cycles, types of feed heating arrangements, Optimum feed water temperature and saving in Heat Rate. direct contact and surface heaters.

Unit 5 Reheating of steam: Practical reheating and Non- reheating cycles, advantage and disadvantages of reheating, reheat regenerative cycle, regenerative water extraction cycles. Process heat and by product power cycle, pass out turbine, Binary vapour cycle. Condensers**.**

**Suggested Text / Reference Books:**


1. Steam Engineering , S K Jain , Bhariya Publication
2. Steam Engineering Gupta R.B., Satya Prakashan.


**Course Outcomes:**

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

**CO1**: Determine the efficiency and output of a modern Rankine cycle steam power plant from given data, including superheat, reheat, regeneration, and irreversibility's

**CO2**: Calculate the heat rate, fan power consumption, flame temperature and combustion air requirements of conventional steam generators (boilers).

**CO3:** Select the heat transfer tubes needed for condensers and feed water heaters

**CO4**: Explain the blade shapes, and calculate work output of typical turbine stages.

**CO5**: Calculate the performance of gas turbines with reheat and regeneration, and discuss the performance of combined cycle power plants.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | L | M | M | M | - | - | - | - | L | - | L | H | M |
| CO2 | L2 | H | M | M | M | M | - | - | - | - | L | - | L | M | H |
| CO3 | L2 | H | L | M | M | M | - | - | - | - | L | - | L | M | M |
| CO4 | L2 | L | M | L | L | L | - | - | - | - | L | - | L | H | M |
| CO5 | L6 | M | M | L | M | M | - | - | - | - | L | - | L | M | L |

## Automobile Engineering (BTMEPCC506.B)

**Course Objectives:**

- To understand the construction of various parts of an automobile
- To understand the working principle of various parts of an automobile

### Syllabus

**Unit 1** Introduction: Objective, scope and outcome of the course. Frame & Body: Layout of chassis, types of chassis frames and bodies, their constructional features and materials. Clutches: single plate, multi-plate, cone clutch, semi centrifugal, electromagnetic, vacuum and hydraulic clutches. Fluid coupling. Brakes: Classification and function; Mechanical, hydraulic, vacuum air and self engineering brakes; Brake shoes and lining materials.

**Unit 2** Gear Boxes: Sliding mesh, constant mesh, synchromesh and epicyclic gear boxes, Automatic transmission system; Hydraulic torque converter; Drives: Overdrive, Propeller shaft, Universal joints, Differential; Rear axle drives. Hotchkiss and torque tube drives; Rear axle types; Front wheel and All wheel drive.

**Unit 3** Wheels and Tyres: Tyre types, Tyre construction; Tyre inflation pressure, Tyre wear and their causes; Re-treading of the tyre, Steering system: steering gear boxes, Steering linkages, Steering mechanism, Under and Over steering. Steering Geometry, Effect of camber, caster, king pin inclination, toe in and toe out; Power steering; Integral and linkage types , Suspension system: objective and requirements, Suspension spring, front and rear suspension systems, Independent suspension system Shock absorbers.

**Unit 4** Automotive Electrical System: Battery construction, Charging and testing, battery types, Starting and Battery Charging System: Starter motor construction, types of drive, Alternator construction, regulation and rectification. Ignition System: Magneto and coil ignition systems, System components and requirements, Automotive lighting: Wiring systems Electrical instruments; head lamp, electric horn, fuel level indicator.

**Unit 5** Automotive Air Conditioning: Introduction, Loads, Air conditioning system Components, Refrigerants, Fault Diagnosis. Automotive Safety: Safety requirements, Safety Devices, Air bags, belts, radio ranging, NVS (Night Vision System) GPS (Global Positioning System)

**Suggested Text / Reference Books:**


3. Automobile Engineering, Sharma R.P., Dhanpat Rai & Sons.
4. Automobile Engineering, Gupta R.B., Satya Prakashan.
5. Vehicle and Engine Technology, Heniz Heisler, Elsvier Publication.
6. Automobile Engineering (Vol. 1 & 2), Kohli P.L., Tata McGraw Hill.
7. Automatic Transmission, Brejcha M.F., Prentice Hall India.


**Course Outcomes:**

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

**CO1**: Recognize the different parts of the automobile

**CO2**: Explain the working of various parts like engine, transmission, clutch, brakes

**CO3:** Describe how the steering and the suspension systems operate.

**CO4**: Understand the environmental implications of automobile emissions

**CO5**: Develop a strong base for understanding future developments in the automobile industry

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | M | M | M | - | - | - | - | L | - | L | H | M |
| CO2 | L2 | H | M | M | M | M | - | - | - | - | L | - | L | M | H |
| CO3 | L2 | H | M | M | M | M | - | - | - | - | L | - | L | M | M |
| CO4 | L2 | L | L | L | L | L | - | - | - | - | L | - | L | H | M |
| CO5 | L6 | M | M | L | M | M | - | - | - | - | L | - | L | M | L |

## BTMEPEC506.C: Non-Destructive Evaluation & Testing

**Course Objectives:**

- To understand the non destructive evaluation.
- To understand the working principle of various parts of testing

**Syllabus**

Unit 1 Introduction: Objective, scope and outcome of the course. ACOUSTICAL METHODS: Ultrasonic testing- Generation of ultrasonic waves, Horizontal and shear waves, Near field and far field acoustic wave description, Ultrasonic probes- Straight beam, direct contact type, Angle beam, Transmission/reflection type, and delay line transducers, acoustic coupling and media. ULTRASONIC TESTS: Transmission and pulse echo methods, A-scan, B-scan, C-scan, F- scan and P-scan modes, Flaw sizing in ultrasonic inspection: AVG, Amplitude, Transmission, TOFD, Satellite pulse, Multi-modal transducer, zonal method using focused beam. Flow location methods, Signal processing in Ultrasonic NDT; Mimics, spurious echo's and noise. Ultrasonic flaw evaluation.

Unit 2 ELECTRO-MAGNETIC METHODS- magnetic particle inspectionintroduction to electrical impedance, principles of eddy current testing, flaw detection using eddy currents

Unit 3 RADIOGRAPHIC METHODS: Introduction to x-ray radiography, the radiographic process, X-ray and Gamma ray sources, Geometric principles, Factors governing exposure, radio graphic screens,scattered radiation, arithmetic of exposure, radiographic image quality and detail visibility, industrial X-ray films.X-RAY RADIOGRAPHY PROCESES: Fundamentals of processing techniques, process control, the processing room, special processing techniques, paper radiography, sensitometric characteristics of X-ray films, film graininess signal to noise ratio in radiographs. The photographic latent image, radiation protection.

Unit 4 OPTICAL METHODS: holography- Principles and practices of Optical holography, acoustical, microwave, x-ray and electron beam holography techniques.

Unit 5 APPLICATIONS: NDT in flaw analysis of Pressure vessels, piping NDT in Castings, Welded constructions, etc., Case studies.

**Suggested Text / Reference Books:**


8. Automobile Engineering, Sharma R.P., Dhanpat Rai & Sons.
9. Automobile Engineering, Gupta R.B., Satya Prakashan.
10. Vehicle and Engine Technology, Heniz Heisler, Elsvier Publication.
11. Automobile Engineering (Vol. 1 & 2), Kohli P.L., Tata McGraw Hill.
12. Automatic Transmission, Brejcha M.F., Prentice Hall India.


**Course Outcomes:**

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

**CO1**: Select an appropriate NDT technique as per requirement.

**CO2**: Set various process parameters and control the NDT process for the desired output parameters.

**CO3:** Find the internal flaws in the material by NDT and take measures to eliminate them.

**CO4**: Understand and solve various problems encountered like leakage, cracks, blowholes etc with the manufacturing process by analyzing the data.

**CO5**: competent enough to make use of modern tools and software's for analyzing and solving real life problems.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | M | L | M | - | - | - | - | L | - | L | H | M |
| CO2 | L2 | H | M | M | L | M | - | - | - | - | L | - | L | M | H |
| CO3 | L2 | H | M | M | M | M | - | - | - | - | L | - | L | M | M |
| CO4 | L2 | L | L | L | L | L | - | - | - | - | L | - | L | H | M |
| CO5 | L6 | M | M | L | L | M | - | - | - | - | L | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC507: Mechatronics Lab

**Course Objectives:**

- To understand the synergistic concept of mechanical and electronic systems.
- To understand and gain knowledge of different Mechatronics systems.

List of Exercise

**1 Using Transducers Kit :-**

- Characteristics of LVDT
- Principle & Characteristics of Strain Gauge
- Characteristics of Summing Amplifier
- Characteristics of Reflective Opto Transducer

**2 Mobile Robot**

- Program for Operating Buzzer Beep
- Program for Operating Motion control
- Program for Operating Direction control
- Program for Operating White line follower for the given arena

**3 PLC PROGRAMMING**

- Ladder programming on Logic gates ,Timers & counters
- Ladder Programming for digital & Analogy sensors
- Ladder programming for Traffic Light control, Water level control and Lift control Modules

**4 MATLAB Programming**

- Sample programmers on Mat lab
- Simulation and analysis of PID controller using SIMULINK

**Course Outcomes:**

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

**CO1:** Analyze the velocity and direction of fluid power circuit with the help of simulation software.

**CO2:** Study and demonstrate the fluid power circuits using PLC

**CO3:** Observe interface between stepper motor and 8051 micro controller

**CO4:** Simulate the basic electric, hydraulic and pneumatic system using simulation software.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L4 | H | L | H | L | M | - | - | - | - | L | - | L | H | M |
| CO2 | L3 | H | M | L | M | M | - | - | - | - | L | - | L | M | M |
| CO3 | L2 | M | L | H | L | M | - | - | - | - | L | - | L | L | L |
| CO4 | L3 | H | L | M | L | L | - | - | - | - | L | - | L | H | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC508: Heat Transfer Lab

**Course Objectives:**

- To provide the practical exposure to the students with regard to the determination of amount of heat exchange in various modes of heat transfer including condensation & boiling for several geometries.
- To get knowledge of heat exchange for plane, cylindrical & spherical geometries and ability to compare the performance of extended surfaces and heat exchangers

**NAME OF EXPERIMENT**

1 To Determine Thermal Conductivity of Insulating Powders.

2 To Determine Thermal Conductivity of a Good Conductor of Heat (Metal Rod).

3 To determine the transfer Rate and Temperature Distribution for a Pin Fin.

4 To Measure the Emissivity of the Test plate Surface.

5 To Determine Stefan Boltzmann Constant of Radiation Heat Transfer.

6 To Determine the Surface Heat Transfer Coefficient For Heated Vertical Cylinder in Natural Convection.

7 Determination of Heat Transfer Coefficient in Drop Wise and Film Wise condensation.

8 To Determine Critical Heat Flux in Saturated Pool Boiling.

9 To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat Exchangers.

10 To Find the Heat transfer Coefficient in Forced Convection in a tube.

11 To study the rates of heat transfer for different materials and geometries

12 To understand the importance and validity of engineering assumptions through the lumped heat capacity method.

Important Note:

It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation sessional component shall include 30%

weight age to mini project.

Heat exchanger design for different applications, designing for thermal insulation, Use of relevant BIS codes for designing

**Course Outcomes:**

Upon completion of this course, students will be able to:

**CO1:** Understand the basic laws of heat transfer.

**CO2:**Understand the consequence of heat transfer in thermal analyses of engineering systems.

**CO3:** Analyze problems involving steady state heat conduction in simple geometries.

**CO4**: Develop solutions for transient heat conduction in simple geometries.

**CO5:** Understand the fundamentals of convective heat transfer process. i.e. Natural, forced and mixed convection in various type of flow. i.e. internal and external flow.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | L | M | L | L | - | - | - | - | L | - | L | M | M |
| CO2 | L5 | H | L | M | L | M | - | - | - | - | L | - | L | M | M |
| CO3 | L4 | H | H | M | H | M | - | - | - | - | H | - | L | M | M |
| CO4 | L6 | H | H | M | H | L | - | - | - | - | H | - | L | L | M |
| CO5 | L2 | H | H | M | H | M | - | - | - | - | H | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC509: Production Engineering Lab

**Course Objective:**

- To know about tool life, MRR, Cutting forces and surface finish in different machining process
- To understand different types of strength test

**NAME OF EXPERIMENT**

1 Study of various measuring tools like dial gauge, micrometer, vernier caliper and telescopic gauges.

2 Measurement of angle and width of a V-groove by using bevel protector..

3 (a) To measure a gap by using slip gauges

(b) To compare & access the method of small-bore measurement with the aid of spheres.

4 Measurement of angle by using sine bar.

5 (a) Measurement of gear tooth thickness by using gear tooth vernier caliper.

(b) To check accuracy of gear profile with the help of profile projector.

6 To determine the effective diameter of external thread by using three- wire method.

7 To measure flatness and surface defects in the given test piece with the help of monochromatic check light and optical flat.

8 To check the accuracy of a ground, machined and lapped surface - (a) Flat surface (b) Cylindrical surface.

9 Find out Chip reduction co-efficient (reciprocal of chip thickness ratio) during single point turning.

10 Forces measurements during orthogonal turning.

11 Torque and Thrust measurement during drilling.

12 Forces measurement during plain milling operation.

13 Measurement of Chip tool Interface temperature during turning using thermocouple technique.

**Course Outcomes:**

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

**CO1:** Define metal cutting operations in machine tools like lathe, drilling, milling, grinding, shaping, and planning, hobbing.

**CO2:** Understand and describe various machine tools and equipment for manufacturing

**CO3: M**ake various threads

**CO4:** Understand the concept of patterns.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L1 | H | L | H | L | H | - | - | - | - | L | - | L | M | H |
| CO2 | L2 | H | L | H | L | H | - | - | - | - | L | - | L | H | M |
| CO3 | L3 | H | L | H | L | H | - | - | - | - | L | - | L | M | M |
| CO4 | L2 | H | L | M | L | M | - | - | - | - | L | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC510: Machine Design Practice Lab

**Course Objectives:**

- To understand procedure of machine design and develop an ability to apply it for Cotter Joint Design and Knuckle Joint Design etc.
- To acquire a skill of design and drafting the Bolted joint, Coupling, Cotter joint , Knuckle Joint etc. by using CAD software

**List of Exercise**

Sessional Work

1 Material selection and relevant BIS nomenclature

2 Selecting fit and assigning tolerances

3 Examples of Production considerations

4 Problems on:

(a) Knuckle & Cotter joints

(b) Torque: Keyed joints and shaft couplings

(c) Design of screw fastening

(d) Bending: Beams, Levers etc.

(e) Combined stresses: Shafts, brackets, eccentric loading.

**Course Outcomes:**

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

**CO1:** Apply the knowledge of Design Data Hand Book and ISO standards for selection of materials, strengths, standard dimensions of design components.

**CO2:** Apply design and drafting knowledge of CAD software for drafting assembly and details of Bolted joint, Coupling, Cotter joint, Knuckle Joint etc.

**CO3:** Develop Logical and Analytical ability to apply Knowledge of CAD for design of Shaft subjected to direct and combined loading

**CO4:** Apply skill of design and drafting CAD software for standard welded and riveted joint as per ISO standard. Apply the design knowledge and formulation for safe design

**CO5**: Apply design procedure for finding the maximum force the given power screw can lift and able to draft and design on CAD software and compare it with analytical results

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | H | M | M | M | L | - | - | - | - | M | - | L | M | L |
| CO2 | L3 | H | L | L | L | L | - | - | - | - | L | - | L | M | M |
| CO3 | L6 | H | M | M | M | M | - | - | - | - | M | - | L | M | M |
| CO4 | L3 | H | M | M | M | L | - | - | - | - | M | - | L | H | M |
| CO5 | L3 | H | L | L | L | L | - | - | - | - | L | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTMEPSIT511: Industrial Training & Seminar

**Course Objectives:**

- To acquire and apply fundamental principles of engineering.
- To update with all the latest changes in technological world.
- To identify, formulate and model problems and find engineering solution based on a systems approach.

**Course Outcomes:**

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

**CO1:** Capability to acquire and apply fundamental principles of engineering.

**CO2:** Become master in one's specialized technology

**CO3:** Become updated with all the latest changes in technological world.

**CO4:** Ability to identify, formulate and model problems and find engineering solution based on a systems approach.

**Table: Mapping of Course Outcomes with Program Outcomes**

| Course Outcome | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P01 1 | PO 12 | PS O1 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | M | H | L | H | L | - | - | - | - | L | - | L | M | M |
| CO2 | L3 | M | L | H | H | L | - | - | - | - | L | - | M | H | M |
| CO3 | L6 | M | H | M | M | L | - | - | - | - | L | - | M | M | M |
| CO4 | L2 | M | M | M | M | L | - | - | - | - | M | - | L | M | H |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTMESODECA512: Social Outreach, Discipline & Extra Curricular Activities

**Course Objectives:**

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

**Course Outcomes:**

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

**CO1:** Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

**CO2:** Have an impact on academic development, personal development, and civic responsibility

**CO3:** Understand the value of Social Work.

**CO4:** Understand the Significance of Discipline in student's Life

**CO5:** Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P0 11 | PO 12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | - | - | - | - | - | M | L | M | M | - | - | - | - | - |
| CO2 | L4 | - | - | - | - | - | M | M | M | L | - | - | - | - | - |
| CO3 | L1 | - | - | - | - | - | M | L | M | L | - | - | - | - | - |
| CO4 | L2 | - | - | - | - | - | M | M | M | M | - | - | - | - | - |
| CO5 | L2 | - | - | - | - | - | M | M | L | M | - | - | - | - | - |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## Semester VI

| BACHELOR OF TECHNOLOGY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| MECHANICAL ENGINEERING | | | | | | | | |
| SIXTH SEMESTER | | | | | | | | |
| **THEORY PAPERS** | | **No. of Teaching Hours** | | | **Marks Allocation** | | | |
| **Code** | **Subject/Paper** | L | **T** | **P** | **IA** | **EA** | **Total** | **Credits** |
| BTMEPCC601 | Measurement & Metrology | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEPCC602 | Computer Integrated Manufacturing Systems | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEPCC603 | Mechanical Vibrations | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTMEPCC604 | Design of Machine Elements II | 3 | 1 | - | 30 | 70 | 100 | 4 |
| BTMEPCC605 | Quality Management | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMPCCE606.A | Refrigeration & Air Conditioning | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEPCC606.B | Non Conventional Machining Methods | 3 | - | - | 30 | 70 | 100 | 3 |
| BTMEPCC606.C | Micro electro and mechanical systems (MEMS) and Microsystems | 3 | - | - | 30 | 70 | 100 | 3 |
| ***PRACTICALS/VIVA-VOCE*** | | **No. of Teaching Hours** | | | **Sessional** | **Practical** | **Total** | **Credits** |
| BTMEPCC607 | CIMS Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC608 | Vibration Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC609 | Machine Design Practice II Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC610 | Thermal Engineering Lab | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMEPSIT611 | Industrial Training/ Seminar | - | - | 2 | 30 | 20 | 50 | 1 |
| BTMESODECA612 | Social Outreach, Discipline & Extra Curricular Activities | - | - | - | - | - | 50 | 1 |
| **TOTAL** | | 18 | **2** | **12** | **330** | **520** | **900** | **26** |

## BTMEPCC601: Measurement & Metrology

**Course Objectives:**

- To understand procedure and importance of measurement in engineering
- To acquire skills of various measuring tools.

**Syllabus**

**Unit 1:** Introduction: Objective, scope and outcome of the course. Concept of measurement: General concept of measurement, Need for measurement, Generalized measuring system, Units, Standards, Sensitivity, Readability, Range of accuracy, Precision, Accuracy Vs precision, Uncertainty. Repeatability and reproducibility, Errors in measurement, Types of error, Systematic and random error, Calibration, Interchangeability.

**Unit 2:** Linear and angular measurements: Linear measuring instruments: Vernier caliper, Micrometer, Interval measurements:- Slip gauges, Checking of slip gauges for surface quality, Optical flat, Application of limit gauges Comparators:- Mechanical comparators, Electrical comparator, Optical comparator, Pneumatic comparator; Sine bar, Use of sine bar, Limitations of sine bars, Sources of error in sine bars, Bevel protractor, Applications of bevel protractor.

**Unit 3:** Form measurement: Introduction, Screw thread measurement, Thread gauges, Measurement of gears: Gear errors. Surface finish measurement:-Introduction, Elements of surface texture, Analysis of surface finish, Methods of measuring surface finish, Straightness measurement, Flatness testing, Roundness measurements

**Unit 4:** Coordinate measuring machine (CMM):-Types of CMM, Features of CMM, Computer based inspection, 2 Measurement of power, flow and temperature related properties Measurement of force, Accelerometer, Load cells, Bourdon tube. Torque measurement: Torque measurement using strain gauges, Torque measurement using torsion bars, Mechanical dynamometers.

**Unit 5:** Measurement of flow: Variable area meters – Rotameter, Hot wire anemometer, Pitot tube. Temperature measurement, Bimetallic strip, Thermocouples (Thermo electric effects), Thermistors, Pyrometers

**Suggested Text / Reference Books:**


1. Kalpakjian, S. and Steven R. Schmid, Manufacturing, Engineering & Technology, Pearson.
2. Rao, P.N., Manufacturing Technology–Metal Cutting and Machine Tools, Tata McGraw Hill, New Delhi, 2000.
3. Hajra Chowdary, S.K., and Hajra Chowdary, A.K., Elements of Workshop Technology, Vol. II, Asia Publishing House, Bombay.
4. I.C. Gupta, Engineering Metrology, Dhanpat Rai & Sons.
5. R. K. Jain, Engineering Metrology, Khanna Publishers.

**Course Outcomes:**

Upon completion of this course, students will be able to:

CO1: Understand the basic measurement units and calibrate various measuring devices

CO2: Observe error and correction factors of various measuring devices.

CO3: Use load measurement system.

CO4: Understand the thermocouple wire and its uses

CO5: Understand the Capacitance, resistance and inductance.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | H | H | H | H | - | - | - | - | L | - | L | L | M |
| CO2 | L2 | H | M | H | M | M | - | - | - | - | L | - | L | M | M |
| CO3 | L3 | H | H | M | H | L | - | - | - | - | L | - | L | M | L |
| CO4 | L2 | H | L | L | L | L | - | - | - | - | L | - | L | L | M |
| CO5 | L2 | H | L | M | L | M | - | - | - | - | L | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTMEPCC602: Computer Integrated Manufacturing Systems

**Course Objectives:**

- To understand procedure of integration between different manufacturing modules
- To acquire skills of design and drafting different aspect of production in digital era

## Syllabus

**Unit 1:** Introduction: Objective, scope and outcome of the course. Introduction to CIM:Overview of Production Systems, the productcycle, Automation in Production Systems, computer's role inmanufacturing, sources and types of data used in manufacturing.The Beginning of CAM: Historical Background,Numerical Control (NC): Basic components of an NC system,coordinate system and motions control systems. ComputerNumerical Control (CNC): features of CNC, machine control unit,CNC software. Direct Numerical Control and DistributedNumerical Control. Applications, advantages and disadvantages ofNC. Adaptive control of machining system.

**Unit 2:** NC Part programming: Manual and computer assisted partprogramming, Part programming with APT. NC part programmingusing CAD/CAM software. NC cutter path verification.

**Unit 3:** Computer Aided Process Planning: Traditional Process Planning,Retrieval process planning system, Generative Process Planning,Machinability data systems, computer generated time standards.

Group Technology: Introduction, part families, part classificationand coding, coding system and machining cells.

**Unit 4:** Computer Aided Production Management Systems: Introduction tocomputer aided PPC, Introduction to computer aided inventorymanagement, manufacturing resource planning (MRPII), computerprocess monitoring and shop floor control, and computer process control.Computer Aided Quality Control; Computer in quality control,contact inspection methods, Non contact inspection methods,optical and non optical computer aided testing.

**Unit 5:** Computer Aided Material Handling; Computer control on materialhandling, conveying, picking. Ware house control, computerizedmaterial handling for automated inspection and assembly.Computer Integrated Manufacturing Systems: Introduction, type's special manufacturing systems, flexible manufacturing systems(FMS).Collaborative Engineering; Introduction, Faster Design throughput,Web based design, Changing design approaches, extended enterprises, concurrent engineering, Agile and lean manufacturing.

**Suggested Text / Reference Books:**


1. Computer Aided manufacturing, Chang and Wang, Pearson Publisher.
2. Automation Production Systems and Computer Integrated manufacturing, Grover M.P., Pearson Publisher. 44
3. CAD/CAM: Principles and Applications, Rao P.N., McGraw-Hill Publication.
4. Computer Control of Manufacturing System, Koren Y., McGraw-Hill Publication.
5. Computer Aided Manufacturing, Rao and Khundra, McGraw-Hill Publication.

6. Computer Numerical Control: Machining and Turning Center, Ruesada and Jeyapoovan, Pearson Publisher.

**Course Outcomes:**

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

CO1. Identify key decision areas for operating managers and researchers for design of production planning & control systems

CO2. Adapt competitive priorities and manufacturing strategies for a given production system to derive strategic advantage.

CO3. Apply ROP, MRP and JIT systems for inventory control in production systems.

CO4. Design push and pull systems using the principles of factory dynamics.

CO5. Design factory systems for shop floor control, production scheduling, aggregate planning and capacity planning.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | L | H | L | - | - | - | - | - | L | - | L | M | M |
| CO2 | L3 | H | L | M | L | L | - | - | - | - | L | - | L | L | M |
| CO3 | L3 | H | L | M | L | L | - | - | - | - | L | - | L | H | M |
| CO4 | L6 | H | L | M | L | L | - | - | - | - | L | - | L | L | L |
| CO5 | L6 | H | M | H | M | L | - | - | - | - | L | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC603: Mechanical Vibrations

**Course Objectives:**

- To formulate mathematical models of problems in vibrations using Newton's second law or energy principles,
- To determine solutions to the modeled mechanical vibration problems.
- To correlate results from the mathematical model to physical characteristics of the actual system.
- To design of a mechanical system using fundamental principles developed in the class.

### Syllabus

**Unit 1: Introduction:** Objective, scope and outcome of the course. Introduction to Sound: Frequency dependent human response to sound, Sound pressure dependent human response, Relationship among sound power, sound intensity and sound pressure level. Introduction to Noise: Auditory and Non auditory effects of Noise, Major sources of the noise, Industrial noise sources, Industrial noise control strategies. Introduction to Vibration: Importance and scope of vibrations, terminology and classification, Concept of Degrees of freedom, Harmonic motion, vectorial representation, complex number representation, addition.

**Unit 2: Undamped Single Degree of Freedom System:** Derivation of equation of motion for one dimensional longitudinal, transverse and Torsional vibrations without damping using Newton's second law, D' Alembert's principle and Principle of conservation of energy, Compound pendulum and centre of percussion. Damped vibrations of single degree of freedom systems: Viscous damping, under-damped, critically damped and over-damped systems, Logarithmic decrement. Vibration characteristics of Coulomb damped system and Vibration characteristics of Hysteretic damped systems.

**Unit 3: Forced Vibrations of Single Degree of Freedom Systems:** Forced vibration with constant harmonic excitation, Steady state and transient parts, Frequency response curves and phase angle plot, Forced vibration due to excitation of support. Vibration Isolation and Transmissibility: Force transmissibility, Motion transmissibility, Forced vibration with rotating and reciprocating unbalance, Materials used in vibration isolation.

**Unit 4: System with Two Degrees of Freedom:** principle mode of vibration, Mode shapes, Undamped forced vibrations of two degrees of freedom system with harmonic excitation, Vibration Absorber, Undamped dynamic vibration absorber and centrifugal pendulum absorber Critical Speed of Shaft: Critical speed of a light shaft without damping, critical speed of shaft having multiple discs, secondary critical speed.

**Unit 5: Many Degrees of Freedom Systems (Exact analysis):** Equation of Motion, The matrix method, Eigen Values and Eigen Vectors, Method of influence Coefficients and Maxwell's reciprocal theorem. Torsional vibrations of multi rotor system, vibrations of geared system, Generalized coordinates and coordinate coupling Many Degrees of Freedom Systems (approximate methods): Rayleigh's, Dunkerley's, Stodola's and Holzer's methods Vibrations of continuous systems: Transverse vibration of a string, Longitudinal vibration of a bar, Torsional vibration of a shaft

**Suggested Text / Reference Books:**


1. Mechanical Vibrations, Rao S.S., Pearson Education.
2. Mechanical Vibrations and Noise Engineering, Ambekar A.G., Prentice Hall India.
3. Mechanical Vibrations, Grover G.K., Nem Chand and Brothers.
4. Theory of Vibrations with Applicaion, Thomson and Dahleh, Pearson Education.
5. Elements of Vibration Analysis, Leonard Meirovitch, Tata McGraw-Hill, New Delhi.
6. Principles of Vibration, Benson H.Tongue, Oxford Publcation.


**Course Outcomes:**

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

**CO1**: determine the equations of motion for free-body diagrams.

**CO2:** Construct the governing differential equation and its solution for a vibrating mass subjected to an arbitrary force

**CO3:** Examine any periodic function into a series of simple harmonic motions using Fourier series analysis.

**CO4:**. Solve for the motion and the natural frequency for forced vibration of a single degree of freedom damped or undamped system.

**CO5: S**olve vibration problems that contain multiple degrees of freedom.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L5 | H | H | M | H | L | - | - | - | - | L | - | L | M | H |
| CO2 | L6 | H | H | M | L | L | - | - | - | - | L | - | L | L | M |
| CO3 | L4 | H | H | M | L | L | - | - | - | - | L | - | L | M | M |
| CO4 | L3 | H | H | M | H | L | - | - | - | - | L | - | L | L | M |
| CO5 | L3 | H | H | H | L | M | - | - | - | - | L | - | L | L | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC604: Design of Machine Elements-II

**Objectives:**

- To understand design procedures for mechanical power transmission components
- To study power transmitting and power controlling elements

**Syllabus**

**Unit 1:** Introduction: Objective, scope and outcome of the course. Fatigue Considerations in Design: Variable load, loadingpattern, endurance stresses, Influence of size, surface finish, notchsensitivity and stress concentration.

**Unit 2:** Goodman line, Soderberg line, Design of machine memberssubjected to combined, steady and alternating stresses. Design for finite life, Design of Shafts under Variable Stresses,Bolts subjected to variable stresses.

**Unit 3:** Design of IC Engine components:Piston, Cylinder, Connecting Rod and Crank Shaft. Design of helical compression, tension, torsional springs, springsunder variable stresses.

**Unit 4:** Design of belt, rope and pulley drive system, Design of gear teeth: Lewis and Buckingham equations, wearand dynamic load considerations. Design and force analysis of spur, helical, bevel and worm gears, Bearing reactions due to gear tooth forces.

**Unit 5:** Design of Sliding and Journal Bearing: Methods oflubrication, hydrodynamic, hydrostatic, boundary etc. Minimum filmthickness and thermal equilibrium.Selection of anti-friction bearings for different loads and load cycles, Mounting of the bearings, Method of lubrication.

**Suggested Text / Reference Books:**


1. Mechanical Machine Design, Bahl and Goel, Standard Publishers Distributors.
2. Design of Machine Elements, Bhandari V.B, Tata McGraw-Hill, New Delhi.
3. Machine Design, Sharma and Aggarwal, Kataria and Sons, Delhi.
4. Mechanical Engg Design, Shigley, Mischke, Budynas and Nisbett, Tata McGraw-Hill
5. Machine Design, Kulkarni S. G., Tata McGraw Hill
6. PSG Design Data Book, P.S.G. College of Technology, Coimbatore.
7. A Text Book of Machine Design, Karwa A., Laxmi Publication.
8. Machine Design, Hall, Holwenko and Laughlin, Schaum's Outlines Series, Tata McGraw Hill.


**Course Outcomes:**

Upon completion of this course, students will able to:

CO1: GetKnowledge of Fatigue Considerations in Design

CO2:Understand Pre loading of bolts.

CO3: Describe about design of helical compression, tension & torsional springs

CO4: Understand springs under variable stresses.

CO5: Examine design of gear teeth, Design of sliding & journal bearing

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L1 | H | H | L | H | H | - | - | - | - | H | - | L | M | M |
| CO2 | L2 | H | M | H | M | L | - | - | - | - | M | - | L | M | M |
| CO3 | L2 | H | M | L | M | L | - | - | - | - | M | - | L | M | M |
| CO4 | L2 | H | M | L | M | M | - | - | - | - | M | - | L | H | M |
| CO5 | L4 | H | M | L | M | L | - | - | - | - | M | - | L | M | H |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC605: Quality Management

**Objectives:**

- To understand total quality management principles and processes
- To impart knowledge to develop a product with the required quality at a reasonable price and to satisfy the requirements under various quality standards

### Syllabus

**Unit 1:** Introduction: Objective, scope and outcome of the course. The meaning of Quality and quality improvement dimensions ofquality, history of quality methodology, quality control, Quality ofdesign and quality of conformance, Quality policy and objectives,Economics of quality.Modeling process quality: Describing variation, frequencydistribution, continuous and discrete, probability distributions,pattern of variation, Inferences about process quality: samplingdistributions and estimation of process parameters. Analysis ofvariance.

**Unit 2:** Statistical Quality Control: Concept of SQC, Chance and assignablecauses of variation, statistical basis of control chart, basicprinciples, choice of control limits, sample size and samplingfrequency, analysis of patterns on control charts. The magnificentseven.

**Unit 3:** Control chart for variables,: X-bar and R charts, X-bar and Scharts, control chart for individual measurement. Application ofvariable control charts. Control chart for attributes: control chart for fraction non conformingP- chart, np-chart, c-chart and u-chart. Demerit systems, choicebetween attribute and variable control chart. SPC for short productionruns. Process capability analysis using histogram and probabilityplot, capability ratios and concept of six sigma.

**Unit 4:** Quality Assurance: Concept, advantages, field complaints, qualityrating, quality audit. Acceptance Sampling: Fundamental concepts in acceptancesampling, operating characteristics curve. Acceptance samplingplans, single, double and multiple sampling plans, LTPD, AOQL,AOQ.Introduction to Quality systems like ISO 9000 and ISO 14000.

**Unit 5:** Reliability and Life Testing- Failure models of components,definition of reliability, MTBF, Failure rate, common failure rate curve,types of failure, reliability evaluation in simple cases of exponentialfailures in series, paralleled and series-parallel deviceconfigurations, Redundancy and improvement factors evaluations. Introduction to Availability and Maintainability, Introduction to Taguchi Method of Design of Experiments, Qualityloss function.

**Suggested Text / Reference Books:**


1. Dale, B. (2015). Total quality management. John Wiley & Sons, Ltd.
2. Mitra, A. (2016). Fundamentals of quality control and improvement. John Wiley & Sons.
3. The Management and Control of Quality" by James R Evans and William M Lindsay
4. TQM – Text with Cases" by Oakland J S
5. Total Quality Management" by Suganthi L and Anand Samuel
6. Total Quality Management- Text and Cases" by Janakiraman B and Gopal R K


**Course Outcomes:**

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

**CO1:** Use the tools and techniques of TQM in manufacturing and service sectors.

**CO2:**Select appropriate quality tools to be applied for specific situations to meet industrial requirements.

**CO3:**Plan industries according to the various National and International quality standards.

**CO4:** Use the Quality Function Development

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | M | M | L | M | - | - | - | M | - | L | - | L | M | M |
| CO2 | L1 | M | M | L | M | - | - | L | M | - | L | - | M | M | M |
| CO3 | L6 | M | M | L | M | - | - | - | M | - | L | - | M | L | M |
| CO4 | L3 | M | M | L | M | - | - | L | - | - | L | - | H | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPEC606.A: Refrigeration and Air Conditioning

**Objectives:**

- To understand concept of refrigeration
- To impart knowledge to develop a product with the required qualityfor air conditioning

**Syllabus**

Unit1: **Introduction:** Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle.

**Vapour Compression Refrigeration System:** Analysis of simple vapour compression Refrigeration cycle by p-h and T-S diagram. Effect of operating conditions

**Multiple Evaporator and compressor system:** Application, air compressor system, Individual compressor, compound compression, cascade system. Application, air compressor systems, individual compressor, compound compression, cascade system.

**Unit 2:**

**Gas Cycle Refrigeration:** Limitation of Carnot cycle with gas, reversed Brayton cycle, Brayton cycle with regenerative heat exchanger. Air cycle for air craft: Necessity of cooling of air craft, Basic cycle, boot

strap, regenerative type air craft refrigeration cycle.

**Unit 3:**

**Other refrigeration systems** (description only): Vapour absorption refrigeration system, Electrolux refrigerator, Lithium Bromide – Water system, Water vapour refrigeration system, Vortex tube refrigeration

system, thermo electric refrigeration system.

**Refrigerants:** Classification, Nomenclature, selection of Refrigerants,

global warming potential of CFC Refrigerants. Refrigeration Equipments: Compressor, condenser, evaporator,

expansion devices, types & working.

**Unit 4:**

**Psychrometry:** Psychrometric properties, psychometric relations, pyschrormetric charts, psychrometric processes, cooling coils, By-pass factor, Apparatus Dew point temperature and air washers.

**Human Comfort:** Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart.

**Unit 5:**

**Cooling load calculations:** Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychrometric calculation for cooling.

**Selection of air conditioning:** Apparatus for cooling and dehumidification, Air conditioning system, year round air conditioning.

**TEXT BOOK**

**1** Arora, C.P., Refrigeration and Air Conditioning, Tata McGraw Hill

**REFERENCE BOOKS**

**1** Stoecker W.F., "Refrigeration & Air Conditioning" McGraw Hill Publication. **2000**

**2** Andrew D. Althouse., "Modern Refrigeration & Air Conditioning" GoodHeart-Willcox Co.**2002**

**3** Jorden & Priester, Refrigeration & Air Conditioning, Prentice Hall of India. **2003**

**4** Roy J. Dossat, Principal of Refrigeration, Pearson Education, New Delhi. **2014**

**5** Edward G. Pita, Air Conditioning Principles and Systems, Pearson Education, New Delhi.**2003**

**6** Jain V.K., Refrigeration & Air Conditioning, Tata McGraw Hill New Delhi. 2004

**Course Outcomes:**

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

**CO1**: Illustrate the fundamental principles and applications of refrigeration and air conditioning system

**CO2**: Obtain cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems

**CO3:** Present the properties, applications and environmental issues of different refrigerants

**CO4**: Calculate cooling load for air conditioning systems used for various

**CO5**: Operate and analyze the refrigeration and air conditioning systems.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | M | M | M | M | - | M | M | - | M | M | - | L | M | M |
| CO2 | L2 | M | M | M | M | - | M | M | - | M | M | - | M | M | M |
| CO3 | L4 | L | M | M | M | - | M | M | - | L | M | - | M | M | M |
| CO4 | L2 | M | M | M | M | - | M | M | - | L | M | - | H | M | M |
| CO5 | L6 | M | M | L | M | M | - | - | - | - | L | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC606.B: Non Conventional Machining Methods

**Objectives:**

- To understand unconventional techniques and processes of manufacturing
- To impart knowledge to develop a product with the required quality at a reasonable price and to satisfy the requirements under various quality standards

**Syllabus**

**Unit1**: Introduction and classification of advanced machining process, consideration in process selection, difference between traditional and non-traditional process, Hybrid process.Abrasivefinishingprocesses:AFM,MAF(forPlainandcylindricalsurfaces).

**Unit2:**
Mechanicaladvancedmachiningprocess:Introduction,Mechanicsofmetalremoval,processprinciple, Advantages,disadvantagesandapplicationsofAJM,USM,WJC.

**Unit3:**
Thermoelectricadvancedmachiningprocess:Introduction,Principle,processparameters,advantages, disadvantagesandapplicationsaboutEDM,EDG, LBM,PAM,EBM

**Unit4:**
Electrochemicalandchemicaladvancedmachiningprocess:ECM,ECG,ESD,Chemicalmachining,A nodeshapeprediction andtooldesignforECMprocess.Tool(cathode)designforECMProcess.

**Unit5:** IntroductiontoMicroandnanomachining

**Suggested Text / Reference Books:**

1. Modern Machining Process by Pandey and Shah
2. Advanced Analysis of Nontraditional Machining by Hong Hocheng
3. Nontraditional Machining Processes by E Weller
4. Non-Traditional Machining Processes by Jagadeesha T
5. Nontraditional Machining Processes: Research Advances by J Paulo Davim

**Course Outcomes:**

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

**CO1**: Understand Non-Conventional sources of energy technologies

**CO2**: Understand various renewable energy technologies and systems.

**CO3**: Classify storage technologies from the autonomous renewable energy sources

**CO4:**Understandvarious possible mechanisms about renewable energy projects

**Table : Mapping of Course Outcomes with Program Outcomes**

| Course Outcome | Bloom level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | M | M | - | M | M | - | M | M | - | L | M | M |
| CO2 | L2 | H | M | M | M | - | M | M | - | M | M | - | M | M | M |
| CO3 | L4 | H | M | M | M | - | M | M | - | L | M | - | M | M | M |
| CO4 | L2 | H | M | M | M | - | M | M | - | L | M | - | H | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC606.C: MEMS and Microsystems

**Course Objectives:**

- To understand different aspects of microelectromechanical Systems.
- To familiarize the working of microsystem design and fabrication
- To expose the principles of thermo fluid engineering

**Syllabus**

**Unit 1:** Over view of MEMS and Microsystems: Microelectromechanical Systems(MEMS) and Microsystems, Typical MEMS and Microsystem products, Evaluation of Microfabrication, Microsystem and microelectronics, themultidisciplinary nature of microsystem design and manufacture,Microsystems and miniaturization, Application of Microsystems in theautomotive industry, applications of Microsystems in other industries. Working Principles of Microsystems: Introduction, Microsensors,Microactuation, MEMS with Microactuators, Microaccelerometers,Microfluidics.

**Unit2:** Engineering Science forMicrosystem Design and Fabrication:Introduction, atomic structure of matter, ions and ionization, molecule theory of matter and intermolecular forces, doping of semiconductors, thediffusion process, plasma physics, electrochemistry, quantum physics. Engineering Mechanics for Microsystem design: Introduction, staticbending of thin plates, mechanical vibration, thermomechanics,fracturemechanics, thin-film mechanics, overview of finite element stress analysis.

**Unit3:** Thermofluid Engineering andMicrosystem design: Introduction, overviewof the basics of fluid mechanics in Macro and mesoscales, Basic equationsin continuum fluid dynamics, laminar fluid flow in circular conduits,computational fluid dynamics, Incompressible fluid flow in microconduits,fluid flow in submicrometer and nanoscale, overview of heat conduction insolids, heat conduction in multilayered thin films, heat conduction insolids in sub micrometer scale. Scaling laws in Miniaturization: Introduction to scaling, scaling ingeometry, scaling in rigid-body dynamics, scaling in electrostatic forces,scaling in electromagnetic forces, scaling in electricity, scaling in fluidmechanics, scaling in heat transfer.

**Unit4:** Materials for MEMS and Microsystems:Introduction, substrateandwafers, active substrate materials, silicon as a substrate material, siliconcompounds, silicon piezoresistors, gallium arsenide, quartz, piezoelectriccrystals, polymers, packaging materials.5Microsystem Fabrication Processes:Introduction,Photolithography, Ionimplantation, diffusion, oxidation, chemical vapor deposition, physicalvapor deposition-sputtering, deposition by epitaxy, etching.

**Unit5:** Overview of Micromanufacturing: Introduction, bulk micromanufacturing,surface micro machining, LIGA. Microsystem Design: Introduction, design consideration, process design,mechanical design, mechanical design using finite element method,design of silicon die for a micropressure sensor, design of microfluidicnetwork systems, design case:capillary electrophoresis network system.

**Suggested Text / Reference Books:**


1. MEMS and Microsystems: Design, Manufacture, and Nanoscale Engineering By Tai-Ran Hsu
2. Foundation of MEMS" by Chang Liu. Pearson Education.
3. Rai - Choudhury P. "MEMS and MOEMS Technology and Applications", PHI Learning Private Limited, 2009.
4. Sabrie Solomon, "Sensors Handbook," Mc Graw Hill, 1998.
5. Marc F Madou, "Fundamentals of Micro Fabrication", CRC Press, 2nd

Edition, 2002.

**Course Outcomes:**

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

**CO1:** Design MEMS components.

**CO2:** Explain the various MEMS fabrication technologies.

**CO3:** Describe the mechanical, thermal, electrical, magnetic and chemical properties of material.

**CO4:** Discuss the lumped modeling of systems and transducers.

**CO5:** Interpret the micro system dynamics.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L6 | H | M | H | M | H | - | - | - | - | L | - | L | M | M |
| CO2 | L2 | H | M | H | M | M | - | - | - | - | L | - | M | L | M |
| CO3 | L2 | H | H | H | H | M | - | - | - | - | L | - | - | M | L |
| CO4 | L2 | H | H | M | H | H | - | - | - | - | L | - | - | L | M |
| CO5 | L4 | M | M | M | M | H | - | - | - | - | L | - | M | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC607: CIMS Lab

**Course Objectives:**

- To introduce different concepts of part programming.
- To understand the working of computer numerical control.

**List of Experiments**

1. To prepare part programming for plain turning operation.
2. To prepare part program for turning operations using turning cycle.
3. To prepare part program for threading operation.
4. To prepare part program for gear cutting using mill cycle.
5. To prepare part program for multiple drilling in X and Z axis using drilling cycle.

**Important Note**:It is mandatory for every student to undertake a Mini project. Miniproject shall be a group activity. A group shall consist of maximum fivestudents. Final evaluation shall include 30% weight age to mini project.

- Engraving of students' name, manufacturing of a part.

**Course Outcomes:**

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

**CO1:** Apply knowledge about Computer Aided Quality control and Process Planning Control.

**CO2:** Design Flexible manufacturing cell after carrying out Group technology study and finally creating FMS.

**CO3:** Apply knowledge about various methods of communication in CIMS.

**CO4:** Apply data management and its importance for decision making in CIMS environment.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | M | L | L | L | L | M | - | - | - | L | - | L | M | M |
| CO2 | L6 | L | L | L | L | - | L | - | - | - | L | - | M | M | M |
| CO3 | L3 | M | H | H | H | - | M | - | - | - | L | - | M | M | L |
| CO4 | L3 | L | M | M | M | L | M | - | - | - | L | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC608: Vibration Lab

**Course Objectives:**

- To understand measurement and analysis techniquesof mechanical vibration systems
- To formulate mathematical models of problems in vibrations using Newton's second law or energy principles

**List of Experiments**

1. To verify relation T = 2π□(l/g) for a simple pendulum.

2. To determine radius of gyration of compound pendulum.

3. To determine the radius of gyration of given bar by using bifilar suspension.

4. To determine natural frequency of a spring mass system.

5. Equivalent spring mass system.

6. To determine natural frequency of free torsional vibrations of single rotor system.

i. Horizontal rotor

ii. Vertical rotor

7. To verify the Dunkerley's rule.

8. Performing the experiment to find out damping co-efficient in case of free damped torsional vibration

9. To conduct experiment of trifler suspension.

10. Harmonic excitation of cantilever beam using electro-dynamic shaker and determination of resonant frequencies.

11. Study of Vibration measuring instruments.

12. Perform study of the following using Virtual Lab http://www.vlab.co.in/

13. Forced Vibration of a Cantilever Beam with a Lumped Mass at Free End: To calculate the natural freq and damping ratio for forced vibration of a single DOF cantilever beam system, experimentally; and compare the results with theoretical values.

14. Harmonically Excited Forced Vibration of a Single DOF System: To analyze the forced vibration response of a single DOF system at diff damping ratio and frequency ratio.

15. Perform study of the following using Virtual Lab http://www.vlab.co.in/

16. Forced Vibration of a Cantilever Beam with a Lumped Mass at Free End: To calculate the natural freq and damping ratio for forced vibration of a single DOF cantilever beam system, experimentally; and compare the results with theoretical values.

17. Harmonically Excited Forced Vibration of a Single DOF System: To analyze the forced vibration response of a single DOF system at diff damping ratio and frequency ratio.

**Course Outcomes:**

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

**CO1:** Use frequency and time domain measurement systems and analysis techniques for vibrational systems.

**CO2**: Construct the equations of motion for free-body diagrams.

**CO3**: Solve for the motion and the natural frequency of a freely vibrating single degree of freedom undamped motion

**CO4:**Construct the governing differential equation and its solution for a vibrating mass subjected to an arbitrary force.

**CO5:**Solve for the motion and the natural frequency for forced vibration of a single degree of freedom damped or undamped system.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | H | L | M | L | - | - | - | - | - | L | - | L | M | M |
| CO2 | L6 | H | H | H | H | - | - | - | - | - | H | - | L | M | M |
| CO3 | L4 | H | L | M | L | - | - | - | - | - | L | - | L | M | M |
| CO4 | L6 | H | L | H | L | - | - | - | - | - | L | - | L | M | M |
| CO5 | L4 | H | H | M | H | - | - | - | - | - | H | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC609: Machine Design Practice-II Lab

**Course Objectives:**

- To apply measurement and analysis techniques to mechanical compression and tension systems
- To formulate mathematical models and designtransmission systems.

Problems on:

Use data hand book by Mahadevan and Reddy

1. Fatigue loading.
2. Helical compression, tension and torsional springs design.
3. Curved Beams.
4. Preloaded bolts and bolts subjected to variable stresses.
5. Belt, Rope and Chain drive system.
6. Gear Design.
7. Sliding contact bearing design.
8. Anti-friction bearing selection

Important Note: It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation shall include 30% weight age to mini project.

- Design of assembly (mechanical systems) using various BIS codes/databook

**Course Outcomes:**

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

**CO1:** Understand Fatigue loading and tension in different springs.

**CO2:**Understand bolts subjected to variable stresses.

**CO3:**Understand Sliding contact bearing design and Anti-friction bearing selection its applications.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | L | M | L | L | - | - | - | - | L | - | L | M | M |
| CO2 | L2 | H | L | L | L | L | - | - | - | - | L | - | L | M | M |
| CO3 | L2 | H | L | H | L | L | - | - | - | - | L | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC610: Thermal Engineering Lab

**Course Objectives:**

- To understand otto and diesel engine technology
- To understand fundamentals of thermodynamics in internal combustion engines.

**List of Experiments**

1.Study of working of four stroke petrol engine and four stroke diesel engine with the help of cut section models

2. Study of working of two stroke petrol and two stroke diesel engine with the help of cut section models.

3. To draw valve timing diagram for a single cylinder diesel engine.

4. Study of various types of boilers.

5. Study of various types of mountings and accessories.

6. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.

7. Study of braking system with specific reference to types of braking system, master cylinder, brake shoes.

8. Study of transmission system including clutches, gear box assembly and differential box

**Course Outcomes:**

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

CO1: Compute the property of fuels and lubricating oils using suitable tests.

CO2: Demonstrate the performance of internal combustion engines and air compressors

CO3: Interpret the emission characteristics of internal combustion engines

**Table : Mapping of Course Outcomes with Program Outcomes**

| Course Outcome | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | H | L | M | L | L | - | - | - | - | L | - | L | M | M |
| CO2 | L3 | H | L | M | L | L | - | - | - | - | L | - | L | H | M |
| CO3 | L4 | H | L | H | L | L | - | - | - | - | L | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTMEPSIT611: Industrial Training & Seminar

**Course Objectives:**

- To acquire and apply fundamental principles of engineering.
- To update with all the latest changes in technological world.
- To identify, formulate and model problems and find engineering solution based on a systems approach.

**Course Outcomes:**

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

**CO1:** Capability to acquire and apply fundamental principles of engineering.

**CO2:** Become master in one's specialized technology

**CO3:** Become updated with all the latest changes in technological world.

**CO4:** Ability to identify, formulate and model problems and find engineering solution based on a systems approach.

**Table: Mapping of Course Outcomes with Program Outcomes**

| Course Outcome | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P011 | PO 12 | PS O1 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | M | H | L | H | L | - | - | - | - | L | - | L | M | M |
| CO2 | L3 | M | L | H | H | L | - | - | - | - | L | - | M | H | M |
| CO3 | L6 | M | H | M | M | L | - | - | - | - | L | - | M | M | M |
| CO4 | L2 | M | M | M | M | L | - | - | - | - | M | - | L | M | H |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTMESODECA612: Social Outreach, Discipline & Extra Curricular Activities

**Course Objectives:**

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

**Course Outcomes:**

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

**CO1:** Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

**CO2:** Have an impact on academic development, personal development, and civic responsibility

**CO3:** Understand the value of Social Work.

**CO4:** Understand the Significance of Discipline in student's Life

**CO5:** Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P0 11 | PO 12 | PS O1 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | - | - | - | - | - | M | L | M | M | - | - | - | - | - |
| CO2 | L4 | - | - | - | - | - | M | M | M | L | - | - | - | - | - |
| CO3 | L1 | - | - | - | - | - | M | L | M | L | - | - | - | - | - |
| CO4 | L2 | - | - | - | - | - | M | M | M | M | - | - | - | - | - |
| CO5 | L2 | - | - | - | - | - | M | M | L | M | - | - | - | - | - |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## Semester - VII

| THEORY PAPERS | | No. of Teaching Hours | | | Marks Allocation | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Subject/Paper** | L | T | P | IA | EA | Total | Credits |
| BTMEPEC701.A | I.C. Engines | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEPEC701.B | Operation Research | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEPEC701.C | Turbomachines | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| ***Open Elective – I (Choose Any One Subject)*** | | | | | | | | |
| BTMEOEC702.A | Non Destructive System | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEOEC702.B | Environmental Engineering and Disaster | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEOEC702.C | Power Generation Sources | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| ***PRACTICALS/VIVA-VOCE*** | | **No. of Teaching Hours** | | | **Sessional** | **Practical** | **Total** | **Credits** |
| BTMEPCC703 | FEA Lab | 0 | 0 | 3 | 30 | 20 | 50 | 1 |
| BTMEPCC704 | Thermal Engineering Lab-II | 0 | 0 | 3 | 30 | 20 | 50 | 1 |
| BTMEPCC705 | Quality Control Lab | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| BTMEPSIT706 | Industrial Training | 1 | 0 | 0 | 60 | 40 | 100 | 2 |
| BTMEPSIT707 | Seminar | 2 | 0 | 0 | 60 | 40 | 100 | 2 |
| BTMESODECA708 | Social Outreach, Discipline & Extra Curricular Activity | - | - | - | - | - | 50 | 1 |
| **TOTAL** | | 9 | **0** | **8** | **270** | **280** | **600** | 14 |

# BTMEPEC701.A: Internal Combustion Engine

**Course Objectives:**

- To familiarize with the terminology associated with IC engines.
- To understand the basics of IC engines.
- To understand combustion, and various parameters and variables affecting it in various types of IC engines.
- To learn various systems used in IC engines and the type of IC engine required for various applications

## Syllabus

**Unit-I**

**Introduction:** Objective, scope and outcome of the course.

**History of IC engines:** Nomenclature, Classification & Comparison, SI & CI, 4stroke- 2 stroke, First Law analysis, Energy Balance. Fuel air cycles, Actual cycles.

**Testing & Performance:** Performance parameters, Measurement of operating parameters e.g. speed, fuel & air consumption, Powers, IHP, BHP, FHP, Efficiencies Thermal, Mechanical, Volumetric, Emission Measurement, Indian & International standards of Testing, Emission.

**Unit-II**

**Fuel & Combustion:** Combustion in CI & SI engines, Ignition Limits, Stages of combustion, Combustion parameters. Delay period and Ignition Lag, Turbulence and Swirl, Effects of engine variables on combustion parameters, abnormal combustion in CI & SI engines, Detonation & knocking, Theories of detonation, Control of abnormal combustion, Combustion chamber design principles, Types of

combustion chamber.

**Unit-III**

**Alternative Fuels:** Methanol, Ethanol, Comparison with gasoline, Manufacturing, Engine performance with pure Methanol, Ethanol & blends, Alcohols with diesel engine, Vegetable oils, Bio gas.

**Engine Systems & Components:** Fuel System (SI Engine), Carburetion & Injection, process & parameters, properties of A/F mixture, Requirements of A/F ratios as per different operating conditions, Carburettors, types, Aircraft carburettor, comparison of carburetion & injection, F/A ratio calculations.

**Unit-IV**

**CI engine:** Mixture requirements & constraints, Method of injection, Injection systems, CRDI etc. system components, pumps injectors.

**Ignition system:** Conventional & Modern ignition systems Magneto v/s Battery, CB point v/s Electronic ignition, Fuel Ignition Energy requirements. Spark advance, centrifugal, vacuum Firing order, spark plugs.

**Unit-V**

**Engine Friction & Lubrication:** Determination of friction, Lubrication principles, Types of lubrication, Places of lubrication Bearings and piston rings etc., Functions of Lubrication, Properties, Rating and Classification of lubricating oil, Additives, Lubrication systems. Engine Cooling: Requirements of cooling, Areas of heat flow, High temperature regions of combustion chamber. Heat Balance, Cooling Systems, Air, Water Cooling, Cooling system components.

**Suggested Text / Reference Books:**


1. Fundamentals of Internal Combustion Engines, Gupta H.N., Prentice Hall of India.
2. Internal Combustion Engines, Mathur and Sharma, Dhanpat Rai publications.
3. Internal Combustion Engines, F.Edward Obert, Harper and Raw Publisher.
4. Internal Combustion Engines Fundamentals, John B. Heyword, McGraw Hill.
5. Internal Combustion Engines, Lichty, McGraw Hill.


**Course Outcomes:**

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

**CO1:** Understand various types of I.C. Engines and Cycles of operation.

**CO2:** Analyze the effect of various operating variables on engine performance

**CO3:** Identify fuel metering and fuel supply systems for different types of engines

**CO4:** Understand normal and abnormal combustion phenomena in SI and CI engines

**CO5:** Evaluate performance Analysis of IC Engine and justify the suitability of IC Engine for Different application

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | H | H | H | M | - | - | - | - | L | - | L | M | L |
| CO2 | L4 | H | M | H | M | M | - | - | - | - | L | - | L | M | M |
| CO3 | L2 | H | H | H | H | M | - | - | - | - | L | - | L | L | M |
| CO4 | L2 | H | H | H | H | M | - | - | - | - | L | - | L | H | M |
| CO5 | L5 | H | M | H | M | M | - | - | - | - | L | - | L | M | H |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTMEPEC701.B: Operation Research

**Course Objectives:**

- To familiarize with the terminology associated with operation research.
- To understand the basics of optimization.

**Unit 1:Introduction:** Objective, scope and outcome of the course.

**Overview of Operations Research**

**Linear Programming**: Applications and model formulation, Graphical method, Simplex method, duality and Sensitivity analysis.

Transportation Model and Assignment Model including travelling salesman problem.

**Integer Linear Programming:** Enumeration and cutting Plane solution concept, Gomory's all integer cutting plane method, Branch and Bound Algorithms, applications of zero-one integer programming.

**Unit 2:Replacement Models:** Capital equipment replacement with time, group replacement of items subjected to total failure.

**Queuing Theory**: Analysis of the following queues with Poisson pattern of arrival and exponentially distributed service times, Single channel queue with infinite customer population, Multichannel queue with infinite customer population,

**Unit 3:Competitive Situations and Solutions**: Game theory, two person zero sum game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy, approximate solution, and simplified analysis for other competitive situations. Application of linear programming

Theory of Decision making: Decision making under certainty, risk and uncertainty. Decision trees.

**Unit 4:Deterministic Inventory control models:** functional role of inventory, inventory costs, model building, Single item inventory control model without shortages, with shortage and quantity discount. Inventory control model with uncertain demand, service level, safety stock, P and Q systems, two bin system. Single period model. Selective Inventory control techniques.

**Probabilistic Inventory control models:** Instantaneous demand without setup cost and with setup cost, Continuous demand without setup cost

**Unit 5: Simulation**: Need of simulation, advantages and disadvantages of simulation method of simulation. Generation of Random numbers, Generation of Normal Random numbers. Use of random numbers for system simulation. , Monte Carlo simulation, simulation language ARENA, Application of simulation for solving queuing Inventory Maintenance, Scheduling and other industrial problems

**Suggested Text / Reference Books:**

1. Operation Research by D S Hira, S Chand.

2.Operation Research by G Srinivasan, S Chand.

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**Course Outcomes:**

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

**CO1:** Understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type.

**CO2:** Build and solve Transportation Models.

**CO3:** Design new simple models, like: CPM, MSPT to improve decision –making and develop critical thinking and objective analysis of decision problems.

**CO4:** Build and solve Assignment Models.

**CO5:** Evaluate performance Analysis of general problems for optimization problem.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | P011 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | H | H | H | M | - | - | - | - | L | - | L | M | L |
| CO2 | L4 | H | M | H | M | M | - | - | - | - | L | - | L | M | M |
| CO3 | L2 | H | H | H | H | M | - | - | - | - | L | - | L | L | M |
| CO4 | L2 | H | H | H | H | M | - | - | - | - | L | - | L | H | M |
| CO5 | L5 | H | M | H | M | M | - | - | - | - | L | - | L | M | H |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTMEPEC701.C: Turbomachines

**Course Objectives:**

- To introduce the means by which the energy transfers is achieved in the main types of turbomachines and the different behaviors of individual types in operation.
- To understand the basics of turbo engines.

**Unit 1: Introduction:** Objective, scope and outcome of the course.

**Basic Concepts of Turbo Machines:** Definition & classification of Turbo machine, Basic laws and governing equations: continuity equation, steady flow energy equation(1st law of thermodynamics),2nd law of thermodynamics applied to turbo

machines, Newton's 2nd law of motion applied to turbomachines - Euler's pump equation and Euler's turbine equation

Dimensional analysis applied to hydraulic machines, power coefficient, flow coefficient, head coefficient, non-dimensional specific speed, Range of specific speeds for various turbo machines, Dimensional analysis applied to compressible flow machines, pressure ratio as a Function of temperature ratio, mass flow rate

parameter and speed parameter

**Unit 2: Centrifugal Compressors and Fans:** Components and description, velocity iagrams, slip factor, energy transfer, power input factor, stage pressure rise and loading coefficient, pressure coefficient, degree of reaction, Centrifugal compressor characteristic, surging,

rotating Stall and Choking

**Unit 3: Axial Flow Compressors and Fans:** Basic constructional features, Advantages of axial flow compressors, working principle, velocity triangle, elementary theory, stage work, work done factor, stage loading, degree of reaction; vortex theory, simple design calculations,

introduction to blade design, cascade test, compressibility effects, operating characteristics

**Unit 4: Reciprocating Compressors:** Basic constructional features, working principle, work done calculation, single and double acting compressors

**Unit : Centrifugal Pumps:** Main parts, work done and velocity triangles, slip and slip factor, pump losses and efficiencies, minimum starting

speed, net positive suction head, performance curve.

**Unit 5 : Axial Flow Pumps:** Description, velocity triangles, work done on the fluid, energy transfer, axial pump characteristics, cavitation.

**Reciprocating Pumps:** Classification, component and working, single acting and double acting, discharge, work done and power required, coefficient of discharge, indicator diagram, slip, effect of

friction and acceleration, theory of air vessels.

**Suggested Text / Reference Books:**

1."Structural Dynamics of Turbo-Machines" by A S Rangwala Prentice Hall of India.
2."Turbomachines" by B U Pai Dhanpat Rai publications.

**Course Outcomes:**

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

**CO1:** Understand various types of turbo engines and cycles of operation.

**CO2:** Analyze the effect of various operating variables on engine performance

**CO3:** Identify fuel metering and fuel supply systems for different types of turbo engines

**CO4:** Understand normal and abnormal combustion phenomena in turbo engines

**CO5:** Evaluate performance Analysis of turbo engines and justify the suitability of turbo engines for different application

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | H | H | H | M | - | - | - | - | L | - | L | M | L |
| CO2 | L4 | H | M | H | M | M | - | - | - | - | L | - | L | M | M |
| CO3 | L2 | H | H | H | H | M | - | - | - | - | L | - | L | L | M |
| CO4 | L2 | H | H | H | H | M | - | - | - | - | L | - | L | H | M |
| CO5 | L5 | H | M | H | M | M | - | - | - | - | L | - | L | M | H |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC702.A: Non Destructive System

**Course Objectives:**

- To familiarize with the different testing machines.
- To understand the basics of non destructive tastings.

### Syllabus

**Unit-I**

Introduction: Objective, scope and outcome of the course

Overview of NDT: NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterization. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT, Visual inspection, Unaided and aided.

**Unit-II**

Surface Non Destructive Evaluation (NDE) Methods: Liquid Penetrant Testing, Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods. Testing Procedure, Magnetic Particle Testing, Theory of magnetism, inspection materials. Magnetisation methods, Interpretation and evaluation, Principles and methods of demagnetization, Residual magnetism.

**Unit-III**

Thermography and Eddy Current Testing (ET): Thermography, Principles, Contact and non contact inspection methods, Advantages and limitation, Instrumentations and methods, applications. Eddy Current Testing, Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

Ultrasonic Testing (UT) and Acoustic Emission (AE): Ultrasonic Testing, Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A-Scan, B-scan, C-scan. Acoustic Emission Technique, Principle, AE parameters, Applications.

**Unit-IV**

Radiography (RT): Principle, Interaction of X-Ray with matter, imaging, film and film less techniques, Types and use of filters and screens, Geometric factors, Inverse square, law, characteristics of films, Interpretation/ Evaluation, Fluoroscopy, Xero Radiography, Computed Radiography, Computed Tomography.

**Unit-V**

Special Techniques and Applications: Phased array ultrasonic time of flight diffractions, Automated and remote ultrasonic testing, Acoustic pulse reflectometry, Alternative current field method, Case studies on NDT techniques used in aircrafts.

**Suggested Text / Reference Books:**


1. Non - Destructive Testing. Mr. T.Raja
2. Basics of Non-Destructive Testing. Lari.
3. Non-Destructive Testing Techniques. Ravi Prakash.
4. Non-Destructive Test and Evaluation of Materials. J Prasad.


**Course Outcomes:**

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

**CO1:** Understand various theories of testing process and machines

**CO2:**Describe NDT in quality assurance

**CO3:** Interpret Visual Inspection

**CO4:** Understand radiographic testing

**CO5:** Understand penetrate testing

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | H | M | H | H | - | - | - | - | H | - | L | M | M |
| CO2 | L2 | H | M | H | M | M | - | - | - | - | M | - | L | M | M |
| CO3 | L4 | H | H | M | H | M | - | - | - | - | H | - | L | M | M |
| CO4 | L2 | H | H | M | H | M | - | - | - | - | H | - | L | M | M |
| CO5 | L2 | H | M | M | M | M | - | - | - | - | M | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC702.B: Environment Engineering and Disaster Management

**Course Objectives:**

- To understand the basics of different disasters.
- To understand the basics of different tools and methods for disaster management**.**

## Syllabus

**Unit-I**

Introduction: Objective, scope and outcome of the course. (This compulsory for all course )

**Unit-II**

Importance of safe water supply system. Domestic water requirements for urban and rural areas. Sources of Water supply. Intakes and transportation of water.

**Unit-III**

Drinking water quality. Indian Standards of drinking water. Introduction to water treatment for safe drinking, Importance of sanitation.

**Unit-IV**

Domestic waste water: quantity, characteristics, disposal in urban and rural areas. Sewer: types, design discharge and hydraulic design. Introduction to domestic wastewater treatment.

**Unit-V**

Solid waste: quantity, characteristics and disposal for urban and rural areas. Introduction to air pollution. Types of pollutants, properties and their effects on living beings. BIS standards for pollutants in air and their abetments. Introduction to various disaster, Importance of disaster management.

**Suggested Text / Reference Books:**


1. Engineering and Disaster Management by Sanjay K Sharma
2. Disaster Management and Mitigation by Prof R B Singh
3. Disaster Mitigation: Experiences And Reflections by Alka Dhameja and Pardeep Dhameja.
4. Disaster Management: Disaster Management and Mitigation approaches in india by Paritosh Srivastava.
5. Management and Mitigation of Natural Disasters" by Rajan Kumar Sahoo


**Course Outcomes:**

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

**CO1:** Understand Disasters, man-made Hazards and Vulnerabilities

**CO2:** Understand disaster management mechanism

**CO3:** Understand capacity building concepts and planning of disaster managements

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | H | H | H | H | - | L | - | - | L | - | L | M | M |
| CO2 | L2 | H | M | H | M | M | - | L | - | - | L | - | L | M | M |
| CO3 | L2 | H | H | H | H | M | - | L | - | - | L | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC702.C: Power Generation Sources

**Course Objectives:**

- To understand different types of power plant engineering.
- To familiarize with the working of power plants based on different fuels.

### Syllabus

**Unit-I**

INTRODUCTION: World energy status, Current energy scenario in India, Environmental aspects of energy utilization, Environment - Economy - Energy and Sustainable Development, Energy planning.

Conventional Energy Generation Methods: Thermal Power plants: Basic schemes and working principle. Gas Power Plants: open cycle and closed cycle gas turbine plants, combined gas & steam plants-basic schemes. Hydro Power Plants: Classification of hydroelectric plants. Basic schemes of hydroelectric and pumped storage plants. Nuclear Power Plants: Nuclear fission and nuclear fusion. Fissile and fertile materials. Basic plant schemes with boiling water reactor, heavy water reactor and fast breeder reactor. Efficiencies of various power plants.

**Unit-III**

SOLAR ENERGY: Basic concepts, Solar radiation – Measurement, Solar thermal systems – Flat plate and concentrating collectors, Solar passive space - Solar heating and cooling techniques – Solar desalination – Solar Pond - Solar cooker - Solar dryers-Solar furnaces - Solar pumping, Solar green house- Solar thermal electric power plant – Solar photo voltaic conversion – Solar cells – PV applications, Hybrid systems.

**Unit-IV**

WIND ENERGY: Introduction-Availability- Wind power plants , Power from the wind, Wind energy conversion systems, site characteristics, Wind turbines types – Horizontal and vertical axis-design principles of wind turbine – Blade element theory, Magnus effect- Performance. Wind energy Applications – Hybrid systems, Wind energy storage, Safety and environmental aspects.

**Unit-V**

BIOMASS ENERGY: Biomass – usable forms- composition- fuel properties – applications, Biomass resources, Biomass conversion technologies - direction combustion - pyrolysis – gasification -anaerobic digestion, Bioethanol and Biodiesel Production - Economics - Recent developments. Energy farming, Biogas technology - Family biogas plants, Community and institutional biogas plants – design consideration – applications.

OTHER RENEWABLE ENERGY SOURCES: Tidal energy – Wave energy – Open and closed OTEC Cycles – Small hydro – Geothermal energy – Social and environmental aspects.Fuel cell technology - types, principle of operation – applications. Hydrogen energy production - Storage – transportation – utilization.

**Suggested Text / Reference Books:**

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.

2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.

3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

**Course Outcomes:**

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

**CO1-** understand basic knowledge of Different types of Power Plants and site selection

**CO2**- design ash handling and coal handling methods in a the thermal power plant.

**CO3**- calculate performance of thermal power plant.

**CO4**-understand the working of Hydroelectric and Nuclear power plant

**CO5**-understand the working of Diesel & Gas Turbine Power plant

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | H | H | H | H | - | L | - | - | H | - | L | H | M |
| CO2 | L6 | H | M | H | M | M | L | L | - | - | M | - | L | H | M |
| CO3 | L3 | H | H | H | H | M | - | L | - | - | H | - | L | L | L |
| CO4 | L2 | H | H | H | H | M | - | L | - | - | H | - | L | M | M |
| CO5 | L2 | H | M | H | M | M | - | L | - | - | M | - | L | H | H |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC703: FEA Lab

**Course Objectives:**

- To understand the importance of automation for problem solving
- To get the knowledge of various finite elements methodsbased on software's

**Lab Content:**

1. Laboratory work for the solution of solid mechanics problems, heat transfer problems, and free vibration problems A: by using FE packages such as NASTRAN/ANSYS/SIMULIA/ABAQUS
2. Introduction of GUI of the software in the above mentioned areas' realistic problems.
3. Analysis of beams and frames (bending and torsion problems)
4. Plane stress and plane strain analysis problems
5. Problems leading to analysis of ax symmetric solids
6. Problems leading to analysis of three dimensional solids (a) Heat transfer problems

   (b) Modal analysis problem B: by writing own code for finite element analysis using MATLAB for:
7. Plane stress and plane strain analysis problems
8. Modal Analysis problem.

**Course Outcomes:**

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

**CO1:**Demonstrate the ability to create models for trusses, frames, plate structures, machine parts, and components using ANSYS general-purpose software

**CO2:** Examine model multi-dimensional heat transfer problems using ANSYS;

**CO3:** demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation purposes.

**CO4**: Understand the limitations of the FE method and understand the possible error sources in its use.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | H | M | M | M | L | - | - | - | - | M | - | L | M | M |
| CO2 | L4 | H | M | M | M | M | - | - | - | - | M | - | L | M | M |
| CO3 | L3 | H | M | M | M | M | - | - | - | - | M | - | L | M | M |
| CO4 | L2 | H | L | M | L | M | - | - | - | - | L | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC704: Thermal Engineering Lab-II

**Course Objectives:**

- To understand the importance of balancing efficiencies in different engines and systems.
- To get the knowledge of various elements COPs

**Content:**

1. To perform constant speed load test on a single cylinder diesel engine and to plot performance curves: indicated thermal efficiency, brake thermal efficiency, mechanical efficiency Vs. Brake power and heat balance sheet.
2. To estimate the Indicated Power, Friction Power and Mechanical Efficiency of a multi-cylinder Petrol Engine. (Morse Test)
3. Analysis of engine exhaust gases using Orsat apparatus /Engine gas analyzer.
4. Determination of coefficient of performance of Refrigeration cycle and tonnage capacity of refrigeration unit.
5. To determine the COP and tonnage capacity of a Mechanical heat pump.
6. To study various controls used in Refrigeration and Air conditioning system.
7. Study of commercial Refrigeration equipments like cooling towers, hermetically sealed compressors, automotive swash plate compressor etc.
8. To study automotive air conditioning system.
9. Determination of dryness fraction of steam.
10. Study and Performance of Simple Steam Turbine
11. Performance characteristics of Hydraulic turbines.
12. Study and Performance of Gas Turbine Plant.
13. Performance characteristics of variable and rated speed centrifugal pump.

**Course Outcomes:**

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

**CO1:** Demonstrate conduction, convection and radiation heat transfer through experiments.

**CO2:** Interpret heat transfer enhancement mechanisms.

**CO3:** Estimate the size and type of heat exchangers.

**CO4:** Calculate the cooling load of air conditioning systems and cooling towers.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | H | L | L | L | L | - | - | - | - | L | - | L | M | M |
| CO2 | L4 | H | M | L | M | L | - | - | - | - | M | - | M | M | M |
| CO3 | L4 | H | M | M | M | L | - | - | - | - | M | - | M | M | M |
| CO4 | L4 | H | M | M | M | L | - | - | - | - | M | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC705: Quality Control Lab

**Course Objectives:**

- To facilitate the understanding of various industrial engineering working tools.
- To impart knowledge to develop a product within the range of acceptance

**List of Experiment**

1. Case study on X bar chart and R chart of an industrial process output andprocess capability analysis of the process. The charts are to be drawn andcalculations of process capability analysis to be reported.

2. P Chart:

(a)To verify the Binomial Distribution of the number of defective balls bytreating the balls with a red colour to be defective.

(b) To plot a p -chart by taking a sample of n=20 and establish control limits.

3. Case study on C-chart of a product and establish control limits .

4. Operating Characteristics Curve:

(a) To plot the operating characteristics curve for single sampling attribute plan for n = 20; c = 1, 2, 3. Designate the red ball as defective.

(b) To compare the actual O.C. curve with theoretical O.C. curve using approximation for the nature of distribution.

5. Distribution Verification:

(a) To verify Normal Distribution using the experimental setup.

(b) To find the distribution of numbered cardboard chips by random drawingone at a time with replacement. Make 25 subgroups in size 5 and 10 find the type of distribution of sample average in each case. Comment on your observations.

6. To carry out verification of Poisson distribution using experimental set up.

7. Central Limit Theorem:

(a) To show that a sample means for a normal universe follow a normal distribution

(b) To show that the sample means for a non normal universe also follow a normal Distribution.

8. Solve quality control problems using SPC software like STATGRAPHICS/MINITAB/SIGMA XL /SYSTAT/EXCEL etc.

**Course Outcomes:**

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

**CO1**: make a system, component, or process to meet desired needs within realistic constraints

**CO2:** identify the control charts.

**CO3:** draw and calculate the different charts and diagrams.

**CO4:** define standard deviations.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | H | M | H | M | H | - | - | - | - | L | - | L | M | M |
| CO2 | L2 | H | L | H | L | H | - | - | - | - | L | - | L | H | M |
| CO3 | L3 | H | M | H | M | H | - | - | - | - | L | - | L | M | M |
| CO4 | L1 | H | M | H | M | H | - | - | - | - | L | - | L | H | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

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# BTMEPSIT706: Industrial Training

**Course Objectives:**

- To acquire and apply fundamental principles of engineering.
- To identify, formulate and present model problems.
- To identify, formulate and model problems and find engineering solution based on a systems approach.

**Course Outcomes:**

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

**CO1:** Capability to acquire and apply fundamental principles of engineering.

**CO2:** Become master in one's specialized technology

**CO3:** Become updated with all the latest changes in technological world.

**CO4:** Ability to identify, formulate and model problems and find engineering solution based on a systems approach.

**Table: Mapping of Course Outcomes with Program Outcomes**

| Course Outcome | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P011 | PO 12 | PS O1 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | M | H | L | H | L | - | - | - | - | L | - | L | M | M |
| CO2 | L3 | M | L | H | H | L | - | - | - | - | L | - | M | H | M |
| CO3 | L6 | M | H | M | M | L | - | - | - | - | L | - | M | M | M |
| CO4 | L2 | M | M | M | M | L | - | - | - | - | M | - | L | M | H |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTMEPCC707: Seminar

**Course Objectives:**

- To Awareness of how to use values in improving your own professionalism.
- To Learning about personal and communication styles for team building.
- To identify, formulate and present model problems.
- To Learning management of values.

**Course Outcomes:**

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

**CO1:** Personalize and create a communication style for individual & team building.

**CO2:** Use values in improving one's own professionalism

**CO3:** Develop the higher cognitive abilities that are analysis, synthesis and evaluation.

**CO4:** Ability to identify, formulate and present model problems.

**Table: Mapping of Course Outcomes with Program Outcomes**

| Course Outcome | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P01 1 | PO 12 | PS O1 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | M | H | L | H | L | - | - | - | - | L | - | L | M | M |
| CO2 | L3 | M | L | H | H | L | - | - | - | - | L | - | M | H | M |
| CO3 | L6 | M | H | M | M | L | - | - | - | - | L | - | M | M | M |
| CO4 | L2 | M | M | M | M | L | - | - | - | - | M | - | L | M | H |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTMEESODECA708: Social Outreach, Discipline & Extra Curricular Activities

**Course Objectives:**

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

**Course Outcomes:**

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

**CO1:** Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

**CO2:** Have an impact on academic development, personal development, and civic responsibility

**CO3:** Understand the value of Social Work.

**CO4:** Understand the Significance of Discipline in student's Life

**CO5:** Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P0 11 | PO 12 | PS O1 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | - | - | - | - | - | M | L | M | M | - | - | - | - | - |
| CO2 | L4 | - | - | - | - | - | M | M | M | L | - | - | - | - | - |
| CO3 | L1 | - | - | - | - | - | M | L | M | L | - | - | - | - | - |
| CO4 | L2 | - | - | - | - | - | M | M | M | M | - | - | - | - | - |
| CO5 | L2 | - | - | - | - | - | M | M | L | M | - | - | - | - | - |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## Semester – VIII

| THEORY PAPERS | | No. of Teaching Hours | | | Marks Allocation | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Subject/Paper** | L | **T** | **P** | **IA** | **EA** | **Total** | **Credits** |
| BTMEPEC801.A | Hybrid and Electric Vehicles | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEPEC801.B | Supply and Operations Management | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEPEC801.C | Additive Manufacturing | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| ***Open Elective – II (Choose Any One Subject)*** | | | | | | | | |
| BTMEOEC802.A | Finite Elements Methods | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEOEC802.B | Energy Management | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| BTMEOEC802.C | Waste and By-product Utilization | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| | | | | | | | | |
| ***PRACTICALS/VIVA-VOCE*** | | **No. of Teaching Hours** | | | **Sessional** | **Practical** | **Total** | **Credits** |
| BTMEPCC803 | Industrial Engineering Lab | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| BTMEPCC804 | Metrology Lab | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| BTMEPSIT805 | Project | 3 | 0 | 0 | 150 | 100 | 250 | 5 |
| BTMESODECA806 | Social Outreach, Discipline & Extra Curricular Activity | 0 | 0 | 0 | 0 | 0 | 50 | 1 |
| **TOTAL** | | **9** | **0** | **4** | **240** | **260** | **600** | **14** |

## BTMEPCC801.A: Hybrid and Electric Vehicles

**Course Objective:**

- To Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals.
- To understand and discuss different energy storage technologies used for hybrid electric vehicles and their control.
- To analyze various electric drives suitable for hybrid electric vehicles.

### Syllabus

**Unit-I**

**Introduction:** Objective, scope and outcome of the course.

Overview of Rapid Product Development (RPD): Need for thecompression in product development, history of RP systems,Definition of RPD; Components of RPD. Rapid Prototyping (RP);Principle of RP; Technologies and their classifications.

**Unit-II**

**Stereo Lithography Systems**: Principle, Process parameter,Process details, Data preparation, data files and machine details,Application.

**Selective Laser Sintering& Fusion Deposition Modelling:**Selective Laser Sintering: Type of machine, Principle of operation,process parameters, Data preparation for SLS, Applications.Fusion Deposition Modeling: Principle, Process parameter, Pathgeneration, Applications.

**Unit-III**

**Solid Ground Curing**: Principle of operation, Machine details,Applications. Laminated Object Manufacturing: Principle ofoperation, LOM materials. Process details, application.

Selection of RP process; Issues in RP; Emerging trends. **Rapid Tooling (RT):** Introduction to RT, Indirect RT process-Silicon rubber molding, Epoxy tooling, Spray metal tooling andInvestment Casting, Cast kirksite, 3Q keltool, etc.

**Unit-IV**

**Direct RT processes**: Laminated Tooling, Powder Metallurgybased technologies, Welding based technologies, Direct patternmaking (Quick Cast, Full Mold Casting),

Emerging Trends in RT, Reverse Engineering: Geometric dataacquisition, 3D reconstruction, Applications and Case Studies,Engineering applications, Medical applications.

**Unit-V**

Processing Polyhedral Data: Polyhedral B-Rep modeling, STLformat, Defects and repair of STL files,

Introduction to software for RP : Brief overview of Solid view,magics etc.

**Suggested Text / Reference Books:**


1. Additive Manufacturing Technologies by Ian Gibson and David Rosen
2. Design for Additive Manufacturing by Dr Tom Page
3. Additive Manufacturing: Advanced Manufacturing Technology in 3d Print Deposit by Sabrie Soloman
4. The 3D Printing Bible: Everything You Need To Know About 3D Printing by Jerry Rogers


**Course Outcomes:**

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

**CO1:** Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals..

**CO2:** Analyse the use of different power electronics devices and electrical machines in hybrid electric vehicles.

**CO3:** Explain the use of different energy storage devices used for hybrid electric vehicles, their technologies and control and select appropriate technology

**CO4:** Interpret working of different configurations of electric vehicles and its components,

**CO5:** Understand Hybrid vehicle configuration, performance analysis and Energy Management strategies in HEVs

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | H | H | H | H | H | - | - | - | - | L | - | L | M | M |
| CO2 | L1 | H | M | H | M | M | - | - | - | - | L | - | L | M | M |
| CO3 | L2 | H | H | H | H | M | - | - | - | - | L | - | L | M | M |
| CO4 | L5 | H | H | M | H | L | - | - | - | - | L | - | L | M | M |
| CO5 | L4 | H | L | H | L | M | - | - | - | - | L | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC801.B: Supply and Operations Management

**Course Objective:**

- To develop an understanding of how the operations, have strategic importance and can provide a competitive advantage in the workplace.
- To understand the relationship between operations and other business functions.
- To understand techniques of location and facility planning; line balancing; job designing; and capacity planning in operations management.
- To understand the Materials Management function starting from Demand Management through Inventory Management.

**Syllabus**

**Unit-I**

**Introduction:** Objective, scope and outcome of the course.

Overview of Rapid Product Development (RPD): Need for the compression in product development, history of RP systems, Definition of RPD; Components of RPD. Rapid Prototyping (RP); Principle of RP; Technologies and their classifications.

**Unit-II**

**Stereo Lithography Systems**: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application.

**Selective Laser Sintering& Fusion Deposition Modelling:** Selective Laser Sintering: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications. Fusion Deposition Modeling: Principle, Process parameter, Path generation, Applications.

**Unit-III**

**Solid Ground Curing**: Principle of operation, Machine details, Applications. Laminated Object Manufacturing: Principle ofoperation, LOM materials. Process details, application.

Selection of RP process; Issues in RP; Emerging trends. **Rapid Tooling (RT):** Introduction to RT, Indirect RT process-Silicon rubber molding, Epoxy tooling, Spray metal tooling and Investment Casting, Cast kirksite, 3Q keltool, etc.

**Unit-IV**

**Direct RT processes**: Laminated Tooling, Powder Metallurgybased technologies, Welding based technologies, Direct patternmaking (Quick Cast, Full Mold Casting),

Emerging Trends in RT, Reverse Engineering: Geometric data acquisition, 3D reconstruction, Applications and Case Studies, Engineering applications, Medical applications.

**Unit-V**

Processing Polyhedral Data: Polyhedral B-Rep modeling, STLformat, Defects and repair of STL files,

Introduction to software for RP : Brief overview of Solid view,magics etc.

**Suggested Text / Reference Books:**

1. Operation management by W J Stevenson, MGH
2. Operation management by Richard B Chase, MGH

**Course Outcomes:**

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

**CO1:** Identify the elements of operations management and various transformation processes to enhance productivity and competitiveness.

**CO2:** Analyze and evaluate various facility alternatives and their capacity decisions, develop a balanced line of production & scheduling and sequencing techniques in operation environments

**CO3:** Develop aggregate capacity plans and MPS in operation environments.

**CO4:** Plan and implement suitable materials handling principles and practices in the operations.

**CO5:** Plan and implement suitable quality control measures in Quality Circles to TQM

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | H | H | H | H | H | - | - | - | - | L | - | L | M | M |
| CO2 | L1 | H | M | H | M | M | - | - | - | - | L | - | L | M | M |
| CO3 | L2 | H | H | H | H | M | - | - | - | - | L | - | L | M | M |
| CO4 | L5 | H | H | M | H | L | - | - | - | - | L | - | L | M | M |
| CO5 | L4 | H | L | H | L | M | - | - | - | - | L | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC801.C: Additive Manufacturing

**Course Objective:**

- To understand technology used in additive manufacturing.
- To understand importance of additive manufacturing in advance manufacturing process.
- To acquire knowledge, techniques and skills to select relevant additive manufacturing process.
- To explore the potential of additive manufacturing in different industrial sectors.

### Syllabus

**Unit-I**

**Introduction:** Objective, scope and outcome of the course.

Overview of Rapid Product Development (RPD): Need for thecompression in product development, history of RP systems,Definition of RPD; Components of RPD. Rapid Prototyping (RP);Principle of RP; Technologies and their classifications.

**Unit-II**

**Stereo Lithography Systems**: Principle, Process parameter,Process details, Data preparation, data files and machine details,Application.

**Selective Laser Sintering& Fusion Deposition Modelling:**Selective Laser Sintering: Type of machine, Principle of operation,process parameters, Data preparation for SLS, Applications.Fusion Deposition Modeling: Principle, Process parameter, Pathgeneration, Applications.

**Unit-III**

**Solid Ground Curing**: Principle of operation, Machine details,Applications. Laminated Object Manufacturing: Principle ofoperation, LOM materials. Process details, application.

Selection of RP process; Issues in RP; Emerging trends. **Rapid Tooling (RT):** Introduction to RT, Indirect RT process-Silicon rubber molding, Epoxy tooling, Spray metal tooling andInvestment Casting, Cast kirksite, 3Q keltool, etc.

**Unit-IV**

**Direct RT processes**: Laminated Tooling, Powder Metallurgybased technologies, Welding based technologies, Direct patternmaking (Quick Cast, Full Mold Casting),

Emerging Trends in RT, Reverse Engineering: Geometric dataacquisition, 3D reconstruction, Applications and Case Studies,Engineering applications, Medical applications.

**Unit-V**

Processing Polyhedral Data: Polyhedral B-Rep modeling, STLformat, Defects and repair of STL files,

Introduction to software for RP : Brief overview of Solid view,magics etc.

**Suggested Text / Reference Books:**

5. Additive Manufacturing Technologies by Ian Gibson and David Rosen
6. Design for Additive Manufacturing by Dr Tom Page
7. Additive Manufacturing: Advanced Manufacturing Technology in 3d Print Deposit by Sabrie Soloman
8. The 3D Printing Bible: Everything You Need To Know About 3D Printing by Jerry Rogers

**Course Outcomes:**

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

**CO1:** Apply conceptual design and geometric transformation techniques in rapid prototyping.

**CO2:** Know about STL system and STL fusion deposition modeling.

**CO3:**Identify solid ground curing methods and rapid tooling methods.

**CO4:** Determine direct rapid tooling processes and their emerging trends.

**CO5:**Compute Additive Manufacturing Process for optimum part quality.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | H | H | H | H | H | - | - | - | - | L | - | L | M | M |
| CO2 | L1 | H | M | H | M | M | - | - | - | - | L | - | L | M | M |
| CO3 | L2 | H | H | H | H | M | - | - | - | - | L | - | L | M | M |
| CO4 | L5 | H | H | M | H | L | - | - | - | - | L | - | L | M | M |
| CO5 | L4 | H | L | H | L | M | - | - | - | - | L | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC802.A: Finite Elements Methods

**Course Objective:**

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems
- To analyze a physical problem, develop experimental procedures for accurately investigating the problem, and effectively perform and document findings.

### Syllabus

**Unit-I**

**Introduction:** Objective, scope and outcome of the course.

Introduction to FEM, Application of FEM, Advantages of FEM, FEA Software.

**Steps of FEM:** Discretization, Local stiffness matrix, coordinate transformation, Assembly, Global stiffness matrix, imposition of Boundary conditions, Properties of stiffness matrix, Banded symmetric matrix and bandwidth.

**Unit-II**

**One-dimensional Finite Element Analysis:** Basics of structural mechanics, stress and strain tensor, constitutive relation, Principle of minimum Potential, Finite element model concept, Derivation of finite elements equations using potential energy approach for linear and quadratic 1-D bar element.

Shape functions and their properties, Assembly, Boundary conditions, Computation of stress and strain, Problems on 1-D structural analysis.

**Unit-III**

**Two Dimensional Finite Element Analysis:** Finite element formulation using three nodded triangular (CST) element , Plane stress and Plane strain problems,

Shape functions, node numbering and connectivity, Assembly, Boundary conditions, Problems on 2-D structural analysis.

**Unit-IV**

Finite Element Formulation from Governing Differential Equation: Galerkin FEM method.

Application to one dimensional structural problems, one-dimensional heat transfer problems, etc., Introduction to variational formulation (Ritz Method.)

**Unit-V**

**Higher Order Elements:** Lagrange's interpolation formula for shape functions, Convergence of solution, static condensation, p and h methods of mesh refinement, Aspect ratio.

**Suggested Text / Reference Books:**

1. Text Book of Finite Element Analysis, Seshu P., Prentice Hall India.

2. Finite Element Procedure in Engineering Analysis, Bathe K.J., Prentice Hall India.
3. An Introduction to the Finite Element Method, Reddy J.N., Tata McGraw-Hill, New Delhi.
4. Concepts & Applications of Finite Element Analysis, Cook and Plesha, Willey India New Delhi.
5. Introduction to Finite Elements in Engineering, Chandupatla and Belegundu, Prentice Hall India.

**Course Outcomes:**

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

**CO1: U**nderstand different mathematical techniques used in FEM analysis .

**CO2:**Understand the stress and strain role and significance of shape functions in finite elementformulations and use linear, quadratic functions for interpolation.

**CO3:** Understand the concepts of Nodes and elements.

**CO3:** Understand use of FEA in Structural and thermal problem

**CO4:** Understand the application of FEA in heat transfer problem

**CO5:** Learn finite element modeling techniques

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | H | H | H | H | - | - | - | - | L | - | L | H | M |
| CO2 | L2 | H | L | H | L | M | - | - | - | - | L | - | L | M | M |
| CO3 | L2 | H | L | L | L | L | - | - | - | - | L | - | L | M | M |
| CO4 | L2 | H | L | H | L | M | - | - | - | - | L | - | L | H | M |
| CO5 | L1 | H | L | H | L | M | - | - | - | - | L | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC802.B: Energy Management

**Course Objective:**

- To identify the energy management skills and strategies in the energy management system.
- To understand various energy conservation methods useful in a particular industry.
- To prepare an energy audit report.

**Syllabus**

**Unit-I**

Introduction: Objective, scope and outcome of the course.

**Unit-II**

Energy Basics; Energy Demand Management, Conservation &Resource Development, Energy for Sustainable Development.

**Unit-III**

Need for Energy Management by Sector- Industry, Buildings &Houses, Transport, Electric Power.

**Unit-IV**

Need for Energy Management by Sector- Agriculture, Domestic;Energy forecasting techniques; Energy Integration, Energy Matrix.

**Unit-V**

Energy Auditing; Energy management for cleaner production,application of renewable energy, appropriate technologies.

**Suggested Text / Reference Books:**


1. Amlan Chakrabarti, Energy Engineering and Management, Prentice Hall India, 2011.
2. Eastop T. D. and D. R. Croft, Energy Efficiency for Engineers & Technologists, Longman, 1990.
3. Albert Thumann P. E. and W. J. Younger, Handbook of Energy Audits, Fairmont Press, 2008.
4. Doty S. and W. C. Turner, Energy Management Hand book, 7/e, Fairmont Press, 2009.
5. Rao S. and B. B. Parulekar, Energy Technology, Khanna Publishers, 2005.
6. Rai G. D., Non-conventional Energy Sources, Khanna Publishers, 2011.

**Course Outcome:**

After completing this course, the student will be able to:

**CO1:** Identify the scope and outcome of energy management.

**CO2:** Understand energy demand management and conservation of energy.

**CO3:** Understand need of energy management in industry, transport and buildings.

**CO4:** Know about energy forecasting techniques and energy integration and matrix.

**CO5:** Evaluate the techno economic feasibility of the energy conservation technique adopted.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | H | H | H | H | - | - | - | - | L | - | L | M | M |
| CO2 | L2 | H | M | H | M | M | - | - | - | - | L | - | L | H | M |
| CO3 | L2 | H | H | H | H | M | - | - | - | - | L | - | L | M | L |
| CO4 | L1 | H | H | H | H | M | - | - | - | - | L | - | L | M | M |
| CO5 | L4 | H | M | H | M | M | - | - | - | - | L | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC802.C: Waste and By-product Utilization

**Objectives:**

- To understand the type of waste and by products, waste identification, classificationand composition.
- To know the need for waste treatment and utilization

### Syllabus

**Unit-I**

Introduction: Objective, scope and outcome of the course.

**Unit-II**

Types and formation of byproducts and waste; magnitude of wastegeneration in different agro-processing industries; concept scopeand maintenance of waste management and effluent treatment,basics pf Waste Recycling & Resources Recovery System (WRRRS),Temperature, pH, Oxygen demands (BOD, COD), fat, oil andgrease content, metal content, forms of phosphorous and sulphurin waste waters, microbiology of waste, other ingredients likeinsecticide, pesticides and fungicides residues.

**Unit-III**

Waste utilization in various industries, furnaces and boilersrun on agricultural wastes and byproducts, briquetting ofbiomass as fuel, production of charcoal briquette, generation ofelectricity using surplus biomass, producer gas generation andutilization.

**Unit-IV**

Waste treatment and disposal, design, construction, operation andmanagement of institutional community and family size biogasplants, concept of vermi-composting, Pre-treatment of waste:sedimentation, coagulation, flocculation and floatation, Secondarytreatments: Biological and chemical oxygen demand for differentfood plant waste– trickling filters, oxidation ditches, activatedsludge process, rotating biological contractors, lagoons.

**Unit-V**

*Tertiary treatments:* Advanced waste water treatment process-sand,coal and activated carbon filters, phosphorous, sulphur, nitrogenand heavy metals removal, Assessment, treatment and disposal ofsolid waste.

**Suggested Text / Reference Books:**


1. Waste and By-product Utilization By Dr. S. K. Singh
2. Food Processing By-Products and their Utilization, First by Anil K Anal
3. Utilization of Waste from Tropical Fruits by H.K. Sharma and Mandeep Kaur
4. Utilization of By-Products and Treatment of Waste in the Food Industry by Oreopoulou, Vasso, Russ, Winfried.


**Course Outcomes:**

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

**CO1:**.Identify various waste from food industries and understand their characteristics

**CO2:** Understand various methods of waste treatment .

**CO3:** Understand various by products from food industry waste

**CO4:**Apply knowledge for a functional ETP plant to suit requirement.

**CO5:** Understand aspects related to food waste disposal.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | H | M | M | M | M | - | M | - | - | M | - | M | M | M |
| CO2 | L2 | H | M | M | M | M | - | M | - | - | M | - | M | M | M |
| CO3 | L2 | H | M | M | M | M | - | M | - | - | M | - | M | L | L |
| CO4 | L3 | H | M | M | M | M | - | M | - | - | M | - | M | L | L |
| CO5 | L2 | H | M | M | M | M | - | M | - | - | M | - | M | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC803: Industrial Engineering Lab

**Objectives:**

- To understand the various industrial engineering working tools and their uses.
- To impart knowledge to develop a product within the range of acceptance.

**List of Experiment**

1. Determination of time standard for a given job using stopwatch time-study.
2. Preparation of flow process chart, operation process chart and man-machinecharts for an existing setup and development of an improved process.
3. Study of existing layout of a workstation with respect to controls and displays and suggesting improved design from ergonomic viewpoint.
4. To perform ABC analysis for the given set of inventory data.
5. To develop Bill of Materials/Product structure tree and calculate plannedorder release (POR) using MRP format
6. To solve the operations research problems on Linear programming/Transportation/Assignment etc. using OR software's likeTORA/LINGO/LINDO/SAS/EXCEL SOLVER etc.
7. Simulation of inventory system/Queuing system/production system usingMonte-Carlo method.
8. To perform case study on sales forecasting.
9. To perform case study on project management using PERT/CPM.
10. To perform a case study on plant location and layout planning.
11. To perform a case study on capacity planning.

**Course Outcomes:**

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

**CO1:** Evaluate and design a system, component, or process to meet desired needs within realistic constraints

**CO2:** Identify the control charts.

**CO3:** Draw and calculate the different charts and diagrams.

**CO4:** Identify the standard deviations.

**Table : Mapping of Course Outcomes with Program Outcomes**

| Course Outcomes | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L5 | H | M | H | M | H | - | - | - | - | M | - | L | M | M |
| CO2 | L2 | H | L | H | L | H | - | - | - | - | L | - | L | M | L |
| CO3 | L3 | H | M | H | M | H | - | - | - | - | M | - | L | M | M |
| CO4 | L1 | H | M | H | M | H | - | - | - | - | M | - | L | M | L |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## BTMEPCC804: Metrology Lab

**COURSE OBJECTIVES:**

•ToMeasure linear and angular dimensions

•To perform various alignment tests on machine tools

•To Measurethe pressure, flow, speed, displacement and temperature.

**List of Experiment**

1. Study of various measuring tools like dial gauge, micrometer, Vernier caliper and telescopic gauges.
2. Measurement of angle and width of a V-groove by using bevel protector.
3. To measure a gap by using slip gauges
4. Measurement of angle by using sine bar.
5. Study and use of surface roughness instrument (Taylor Hobson make) Inspection of various elements of screw thread by Tool makers microscope and optical projector.
6. Measurement of gear tooth thickness by using gear tooth Vernier caliper.
7. To check accuracy of gear profile with the help of profile projector.
8. To determine the effective diameter of external thread by using three-wire method.
9. To measure flatness and surface defects in the given test piece with the help of monochromatic check light and optical flat.
10. To plot the composite errors of a given set of gears using composite gear tester.
11. Measurement of coating thickness on electroplated part and paint coating on steel and non-ferrous material using coating thickness gauge.
12. Study and use of hardness tester for rubber and plastics.
13. To check the accuracy of a ground, machined and lapped surface - (a) Flat surface (b) Cylindrical surface.
14. To compare & access the method of small-bore measurement with the aid of spheres.

**Course Outcomes:**

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

CO1. Demonstrate the use of instruments for measuring linear (internal and external), angular dimensions and surface roughness.

CO2. Perform alignment tests on various machine tools.

CO3.Demonstrate the use of instruments for measuring pressure, flow, speed, displacement and temperature

CO4.Calibrate the Bourdon tube pressure gauge

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcomes** | Bloom Level | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | H | M | H | M | M | - | - | - | - | M | - | L | M | M |
| CO2 | L3 | H | L | H | L | M | - | - | - | - | L | - | L | M | M |
| CO3 | L3 | H | M | H | M | M | - | - | - | - | M | - | L | M | M |
| CO4 | L4 | H | M | H | M | M | - | - | - | - | M | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTMEPRJ805: Project

**Course Objective:**

- To introduce the concept and methods required for the construction of large software intensive system.
- To develop a broad understanding of the discipline of software engineering and management of software system.
- To provide an understanding of both theoretical and methodological issues involve in modern software engineering project management and focus strongly on practical techniques.

**Course Outcomes:**

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

**CO1:** Capability to acquire and apply fundamental principles of engineering.

**CO2:** Be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills.

**CO3:** Identify, formulate and model problems and find engineering solution based on a systems approach.

**CO4:** Capability and enthusiasm for self-improvement through continuous professional development and life-long learning

**Table: Mapping of Course Outcomes with Program Outcomes**

| Course Outcome | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P01 1 | PO 12 | PS O1 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L3 | M | M | H | L | M | - | - | - | - | M | - | L | M | M |
| CO2 | L3 | M | L | H | L | M | - | - | - | - | L | - | L | M | M |
| CO3 | L3 | M | M | H | L | M | - | - | - | - | M | - | L | M | M |
| CO4 | L4 | M | M | H | L | M | - | - | - | - | M | - | L | M | M |

**H- High, M- Moderate, L- Low, '-' for No correlation**

# BTMEESODECA806: Social Outreach, Discipline & Extra Curricular Activities

**Course Objectives:**

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

**Course Outcomes:**

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

**CO1:** Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

**CO2:** Have an impact on academic development, personal development, and civic responsibility

**CO3:** Understand the value of Social Work.

**CO4:** Understand the Significance of Discipline in student's Life

**CO5:** Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs.

**Table : Mapping of Course Outcomes with Program Outcomes**

| **Course Outcome** | Bloom Level | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P0 11 | PO 12 | PS O1 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L2 | - | - | - | - | - | M | L | M | M | - | - | - | - | - |
| CO2 | L4 | - | - | - | - | - | M | M | M | L | - | - | - | - | - |
| CO3 | L1 | - | - | - | - | - | M | L | M | L | - | - | - | - | - |
| CO4 | L2 | - | - | - | - | - | M | M | M | M | - | - | - | - | - |
| CO5 | L2 | - | - | - | - | - | M | M | L | M | - | - | - | - | - |

**H- High, M- Moderate, L- Low, '-' for No correlation**

## 6. Teaching-Learning Process/ Methodology (TLM):

The teaching-learning process should be aimed at systematic exposition of basic concepts so as to acquire knowledge of technical program in a canonical manner. In this context, applications of technical program and linkage with the theory constitute a vital aspect of the teaching-learning process. The course offers many modes of learning and assessment methods. Students have great freedom of choice of course which they can study. The various components of teaching learning process are summarized in the following heads.

1. **Class room Lectures:** The most common method of imparting knowledge is through lectures.There are diverse modes of delivering lectures such as through blackboard, power point presentation and other technology aided means. A judicious mix of these means is a key aspect of teaching-learning process.
2. **Tutorials:** To reinforce learning, to monitor progress, and to provide a regular pattern ofstudy, tutorials are essential requirements. During these tutorials, difficulties faced by the students in understanding the lectures, are dealt with. Tutorials are also aimed at solving problems associated with the concepts discussed during the lectures.
3. **Practical:** To provide scientific visualization and obtaining results of Technical program inpractical sessions. These sessions provide vital insights into scientific concepts and drawlearner's attention towards limitations of scientific computations. During practical, scientific models arising in real life problems can also be simulated.
4. **Choice based learning/Open elective:** LOCF in this undergraduate program providesgreat flexibility both in terms of variety of courses and range of references in each course.
5. **Field based learning:** Students may enhance their knowledge through field based learningwhile understanding the practical importance.
6. **Textbooks learning:** A large number of books are included in the list of references of eachcourse for enrichment and enhancement of knowledge.
7. **E-learning:** Learner may also access electronic resources and educational websites for betterunderstanding and updating the concepts.
8. **Self-study materials:** Self-study material provided by the teachers is an integral part oflearning. It helps in bridging the gaps in the classroom teaching. It also provides scope for teachers to give additional information beyond classroom learning.
9. **Assignment/Problem solving:** Assignments at regular intervals involving applications oftheory are necessary to assimilate basic concepts of courses. Hence, it is incumbent on the part of a learner to complete open-ended projects assigned by the teacher.
10. **Internships:** The teaching-learning process needs to be further supported by other activitiesdevoted to subject-specific and interdisciplinary skills, summer and winter internships. During these internships it is expected that a learner will interact with experts and write a report on a topic provided to the learner.

11. **Institute visits:** Institute visit by a learner is also a part of learning process. During suchvisits a learner has access to knowledge by attending academic activities such as seminars, colloquia, library consultation and discussion with faculty members. These activities provide guidance and direction for further study.
12. **Industrial visits:** Industrial visits offer an opportunity to observe applications of scientific concepts. These visits also give an opportunity to realize the power of mathematical ideas and their translation in problem solving.
13. **Training programs:** Training programs organized by various agencies/institutes provide an opportunity to learn various dimensions of courses.