

| EST<br>120 | BASICS OF CIVIL & MECHANICAL<br>ENGINEERING | CATEGORY | L   | T | P | CREDIT | YEAR OF<br>INTRODUCTION |
|------------|---|----------|-----|---|---|--------|-------------------------|
|            |   |          | ESC | 4 | 0 | 0      | 4                       |
|            |   |          |     |   |   |        |                         |

**Preamble:**

Objective of this course is to provide an insight and inculcate the essentials of Civil Engineering discipline to the students of all branches of Engineering and to provide the students an illustration of the significance of the Civil Engineering Profession in satisfying the societal needs.

To introduce the students to the basic principles of mechanical engineering

**Prerequisite:** NIL

**Course Outcomes:** After completion of the course, the student will be able to

|       |  |
|-------|--|
| CO 1  | Recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering. |
| CO 2  | Explain different types of buildings, building components, building materials and building construction  |
| CO 3  | Describe the importance, objectives and principles of surveying.   |
| CO 4  | Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps                   |
| CO 5  | Discuss the Materials, energy systems, water management and environment for green buildings.             |
| CO 6  | Analyse thermodynamic cycles and calculate its efficiency  |
| CO 7  | Illustrate the working and features of IC Engines  |
| CO 8  | Explain the basic principles of Refrigeration and Air Conditioning                                       |
| CO 9  | Describe the working of hydraulic machines   |
| CO 10 | Explain the working of power transmission elements   |
| CO 11 | Describe the basic manufacturing, metal joining and machining processes                                  |

**Mapping of course outcomes with program outcomes**

|     | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 |
|-----|------|------|------|------|------|------|------|------|------|-------|-------|-------|
| CO1 | 3    | -    | -    | -    | -    | 3    | 2    | 2    | -    | -     | -     | -     |
| CO2 | 3    | 2    | -    | 1    | 3    | -    | -    | 3    | -    | -     | -     | -     |
| CO3 | 3    | 2    | -    | -    | 3    | -    | -    | -    | 2    | -     | -     | -     |

|      |   |   |   |   |   |   |   |   |   |   |   |   |
|------|---|---|---|---|---|---|---|---|---|---|---|---|
| CO4  | 3 | 2 | - | - | 3 | - | - | - | 2 | - | - | - |
| CO5  | 3 | 2 | - | - | 3 | 2 | 3 | - | 2 | - | - | - |
| CO6  | 3 | 2 |   |   |   |   |   |   |   |   |   |   |
| CO7  | 3 | 1 |   |   |   |   |   |   |   |   |   |   |
| CO8  | 3 | 1 |   |   |   |   |   |   |   |   |   |   |
| CO9  | 3 | 2 |   |   |   |   |   |   |   |   |   |   |
| CO10 | 3 | 1 |   |   |   |   |   |   |   |   |   |   |
| CO11 | 3 |   |   |   |   |   |   |   |   |   |   |   |

#### Assessment Pattern

|                  |  | Basic Civil Engineering |              |                                  | Basic Mechanical Engineering |              |                                  |
|------------------|--|-------------------------|--------------|----------------------------------|------------------------------|--------------|----------------------------------|
| Bloom's Category |  | Continuous Assessment   |              | End Semester Examination (marks) | Continuous Assessment        |              | End Semester Examination (marks) |
|                  |  | Test 1 marks            | Test 2 marks |                                  | Test 1 marks                 | Test 2 marks |                                  |
| Remember         |  | 5                       | 5            | 10                               | 7.5                          | 7.5          | 15                               |
| Understand       |  | 20                      | 20           | 40                               | 12.5                         | 12.5         | 25                               |
| Apply            |  |                         |              |                                  | 5                            | 5            | 10                               |
| Analyse          |  |                         |              |                                  |                              |              |                                  |
| Evaluate         |  |                         |              |                                  |                              |              |                                  |
| Create           |  |                         |              |                                  |                              |              |                                  |

#### Mark distribution

| Total Marks | CIE (Marks) | ESE (Marks) | ESE Duration |
|-------------|-------------|-------------|--------------|
| 150         | 50          | 100         | 3 hours      |

#### Continuous Internal Evaluation Pattern:

- Attendance : 10 marks  
 Continuous Assessment Test (2 numbers) : 25 marks  
 Assignment/Quiz/Course project : 15 marks

#### End Semester Examination Pattern:

There will be two parts; Part I – Basic Civil Engineering and Part II – Basic Mechanical Engineering. Part I and PART II carries 50 marks each. For the end semester examination, part I contain 2 parts -

Part A and Part B. Part A contain 5 questions carrying 4 marks each (not exceeding 2 questions from each module). Part B contains 2 questions from each module out of which one to be answered. Each question carries 10 mark and can have maximum 2 sub-divisions. The pattern for end semester examination for part II is same as that of part I. **However, student should answer both part I and part 2 in separate answer booklets.**

#### **Course Level Assessment Questions:**

**Course Outcome CO1:** *To recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.*

1.Explain relevance of Civil engineering in the overall infrastructural development of the country.

Course outcome 2 (CO2) (One question from each module and not more than two)

*Explain different types of buildings, building components, building materials and building construction*

1. Discuss the difference between plinth area and carpet area.

Course outcome 3 (CO3) (One question from each module and not more than two)

*Describe the importance, objectives and principles of surveying.*

1. Explain the importance of surveying in Civil Engineering

Course outcome 4 (CO4) (One question from each module and not more than two)

*Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps*

1. Explain the civil engineering aspects of elevators, escalators and ramps in buildings

Course outcome 5 (CO5) (One question from each module and not more than two)

*Discuss the Materials, energy systems, water management and environment for green buildings.*

1. Discuss the relevance of Green building in society

#### **Section II Answer any 1 full question from each module. Each full question carries 10 marks**

**Course Outcome 1 (CO1)** (Two full question from each module and each question can have maximum 2 sub-divisions)

*To recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering*

#### **CO Questions**

1. a List out the types of building as per occupancy. Explain any two, each in about five sentences.

b. Discuss the components of a building with a neat figure.

2. a.What are the major disciplines of civil engineering and explain their role in the infrastructural framework.

- b.** Explain the role of NBC, KBR & CRZ norms in building rules and regulations prevailing in our country.

**Course Outcome 2 (CO2) & Course Outcome 3 (CO3) (Two full question from each module and each question can have maximum 2 sub-divisions)**

*Explain different types of buildings, building components, building materials and building construction & Describe the importance, objectives and principles of surveying.*

**CO Questions**

1. a. What are the different kinds of cement available and what is their use.  
b. List the properties of good building bricks. Explain any five.
2. a. List and explain any five modern construction materials used for construction.  
b. Explain the objectives and principles of surveying

**Course outcome 4 (CO4) & Course outcome 5 (CO5) (Two full question from each module and each question can have maximum 2 sub-divisions)**

*Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps & Discuss the Materials, energy systems, water management and environment for green buildings.*

**CO Questions**

1. a. Draw the elevation and plan of one brick thick wall with English bond  
b. Explain the energy systems and water management in Green buildings
2. a. Draw neat sketch of the following foundations: (i) Isolated stepped footing;  
(ii) Cantilever footing; and (iii) Continuous footing.  
  
b. Discuss the civil engineering aspect of MEP and HVAC in a commercial building

**Course Outcome 6 (CO6):**

1. In an air standard Otto cycle the compression ratio is 7 and compression begins at  $35^{\circ}\text{C}$ , 0.1 MPa. The maximum temperature of the cycle is  $1100^{\circ}\text{C}$ . Find  
i) Heat supplied per kg of air,  
ii) Work done per kg of air,  
iii) Cycle efficiency  
Take  $C_p = 1.005 \text{ kJ/kgK}$  and  $C_v=0.718 \text{ kJ/kgK}$
2. A Carnot cycle works with adiabatic compression ratio of 5 and isothermal expansion ratio of 2. The volume of air at the beginning of isothermal expansion is  $0.3 \text{ m}^3$ . If the maximum temperature and pressure is limited to  $550\text{K}$  and 21 bar, determine the minimum temperature in the cycle and efficiency of the cycle.
3. In an ideal diesel cycle, the temperature at the beginning and end of compression is  $65^{\circ}\text{C}$  and  $620^{\circ}\text{C}$  respectively. The temperature at the beginning and end of the expansion is  $1850^{\circ}\text{C}$  and  $850^{\circ}\text{C}$ . Determine the ideal efficiency of the cycle.

4. Explain the concepts of CRDI and MPFI in IC Engines.

**Course Outcome 7 (CO7):**

1. With the help of a neat sketch explain the working of a 4 stroke SI engine
2. Compare the working of 2 stroke and 4 stroke IC engines
3. Explain the classification of IC Engines.

**Course Outcome 8(CO8):**

1. Explain the working of vapour compression refrigeration system.
2. With the help of suitable sketch explain the working of a split air conditioner.
3. Define: COP, specific humidity, relative humidity and dew point temperature.

**Course Outcome 9 (CO9):**

1. Explain the working of a single stage centrifugal pump with sketches.
2. With the help of a neat sketch, explain the working of a reciprocating pump.
3. A turbine is to operate under a head of 25 m at 200 rpm. The discharge is  $9 \text{ m}^3/\text{s}$ . If the overall efficiency of the turbine is 90%. Determine the power developed by the turbine.

**Course Outcome 10 (CO10):**

1. Explain the working of belt drive and gear drive with the help of neat sketches
2. Explain a single plate clutch.
3. Sketch different types of gear trains and explain.

**Course Outcome 11 (CO11):**

1. Describe the operations which can be performed using drilling machine.
2. Explain the functions of runners and risers used in casting.
3. With a neat sketch, explain the working and parts of a lathe.

**Model Question Paper**

**QP CODE: EST120**

page:3

Reg No: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,  
MONTH & YEAR**

**Course Code: EST 120**

**Course Name: BASICS OF CIVIL AND MECHANICAL ENGINEERING**

Max. Marks: 100

Duration: 3 hours

**Answer both part I and part 2 in separate answer booklets**

## PART I: BASIC CIVIL ENGINEERING

### PART A

(Answer all questions. Each question carries 4 marks)

1. Explain relevance of Civil engineering in the overall infrastructural development of the country.
2. Discuss the difference between plinth area and carpet area.
3. Explain different types of steel with their properties.
4. What are the different kinds of cement available and what is their use?
5. Define bearing capacity of soil.

(5 x 4 = 20)

### Part B

Answer one full question from each module.

#### MODULE I

- 6a. List out the types of building as per occupancy. Explain any two, each in about five sentences. (5)
- b. Discuss the components of a building with a neat figure. (5)

OR

- 7a. What are the major disciplines of civil engineering and explain their role in the infrastructural framework. (5)
- b. Explain the role of NBC, KBR & CRZ norms in building rules and regulations prevailing in our country. (5)

#### MODULE II

- 8a. What are the different kinds of cement available and what is their use. (5)
- b. List the properties of good building bricks. Explain any five. (5)

OR

- 9a. List and explain any five modern construction materials used for construction. (5)
- b. Explain the objectives and principles of surveying (5)

#### MODULE III

- 10a. Draw the elevation and plan of one brick thick wall with English bond (5)
- b. Explain the energy systems and water management in Green buildings (5)

OR

- 11a. Draw neat sketch of the following foundations: (i) Isolated stepped footing; (ii) Cantilever footing; and (iii) Continuous footing. (5)
- b. Discuss the civil engineering aspect of MEP and HVAC in a commercial building (5)

[10 x 3 = 30]

## PART II: BASIC MECHANICAL ENGINEERING

### PART A

Answer all questions. Each question carries 4 marks

1. Sketch the P-v and T-s diagram of a Carnot cycle and List the processes.
2. Illustrate the working of an epicyclic gear train.
3. Explain cooling and dehumidification processes.
4. Differentiate between soldering and brazing.
5. Explain the principle of Additive manufacturing.

4 x 5 = 20 marks

### Part B

Answer one full question from each module.

#### MODULE I

6. In an air standard Otto cycle the compression ratio is 7 and compression begins at  $35^{\circ}\text{C}$ , 0.1MPa. The maximum temperature of the cycle is  $1100^{\circ}\text{C}$ . Find
  - i) Heat supplied per kg of air,
  - ii) Work done per kg of air,
  - iii) Cycle efficiency

Take  $C_p = 1.005 \text{ kJ/kgK}$  and  $C_v = 0.718 \text{ kJ/kgK}$  10 marks

OR

7. a) Explain the working of a 4 stroke SI engine with neat sketches.  
b) Explain the fuel system of a petrol engine. 7 marks  
3 marks

#### MODULE II

8. a) Explain the working of a vapour compression system with help of a block diagram.  
b) Define: Specific humidity, relative humidity and dew point temperature. 7 marks  
3 marks

OR

9. With the help of a neat sketch, explain the working of a centrifugal pump. 10 marks

#### MODULE III

10. Explain the two high, three high, four high and cluster rolling mills with neat sketches. 10 marks

OR

11. a) Describe the arc welding process with a neat sketch.  
b) Differentiate between up-milling and down-milling operations. 6 marks  
4 marks

## SYLLABUS

### Module 1

**General Introduction to Civil Engineering:** Relevance of Civil Engineering in the overall infrastructural development of the country. Responsibility of an engineer in ensuring the safety of built environment. Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.

**Introduction to buildings:** Types of buildings, selection of site for buildings, components of a residential building and their functions.

**Building rules and regulations:** Relevance of NBC, KBR & CRZ norms (brief discussion only).

**Building area:** Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.

### Module 2

**Surveying:** Importance, objectives and principles.

**Construction materials,** Conventional construction materials: types, properties and uses of building materials: bricks, stones, cement, sand and timber

**Cement concrete:** Constituent materials, properties and types.

**Steel:** Steel sections and steel reinforcements, types and uses.

**Modern construction materials:-** Architectural glass, ceramics, Plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials. Modern uses of gypsum, pre-fabricated building components (brief discussion only).

### Module 3

**Building Construction:** Foundations: Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only). Load bearing and framed structures (concept only).

**Brick masonry:** - Header and stretcher bond, English bond & Flemish bond random rubble masonry.

**Roofs and floors:** - Functions, types; flooring materials (brief discussion only).

**Basic infrastructure services:** MEP, HVAC, elevators, escalators and ramps (Civil Engineering aspects only), fire safety for buildings.

**Green buildings:-** Materials, energy systems, water management and environment for green buildings. (brief discussion only).

### Module 4

**Analysis of thermodynamic cycles:** Carnot, Otto, Diesel cycles, Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net work and efficiency. IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines. Efficiencies of IC Engines(Definitions only), Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines.

## Module 5

**Refrigeration:** Unit of refrigeration, reversed Carnot cycle,COP, vapour compression cycle (only description and no problems); Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.

Description about working with sketches of: Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles)

Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches.

## Module 6

**Manufacturing Process:** Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications.

**Metal Joining Processes:** List types of welding, Description with sketches of Arc Welding, Soldering and Brazing and their applications

**Basic Machining operations:** Turning, Drilling, Milling and Grinding.

Description about working with block diagram of: Lathe, Drilling machine, Milling machine, CNC Machine. Principle of CAD/CAM, Rapid and Additive manufacturing.

### Text Books:

1. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
2. Mckay, W.B. and Mckay, J. K., Building Construction, Volumes 1 to 4, Pearson India Education Services

### References Books:

1. Chen W.F and Liew J Y R (Eds), The Civil Engineering Handbook. II Edition CRC Press (Taylor and Francis)
2. Chudley, R and Greeno R, Building construction handbook, Addison Wesley, Longman group, England
3. Chudley, R, Construction Technology, Vol. I to IV, Longman group, England Course Plan
4. Kandya A A, Elements of Civil Engineering, Charotar Publishing house
5. Mamlouk, M. S., and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers
6. Rangwala S.C and Dalal K B Building Construction Charotar Publishing house
7. Clifford, M., Simmons, K. and Shipway, P., An Introduction to Mechanical Engineering Part I - CRC Press
8. Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters & Publishers Pvt. Ltd., Mumbai.
9. Sawhney, G. S., Fundamentals of Mechanical Engineering, PHI
10. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018
11. Benjamin J., Basic Mechanical Engineering, Pentex Books, 9<sup>th</sup> Edition, 2018
12. Balachandran, P. Basic Mechanical Engineering, Owl Books

**Course Contents and Lecture Schedule:**

| No  | Topic  | Course outcomes addressed | No. of Lectures |
|-----|--|---------------------------|-----------------|
| 1   | <b>Module I</b>  |                           | <b>Total: 7</b> |
| 1.1 | <i>General Introduction to Civil Engineering:</i> Relevance of Civil Engineering in the overall infrastructural development of the country. Responsibility of an engineer in ensuring the safety of built environment. | CO1                       | 1               |
| 1.2 | Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.            | CO1                       | 2               |
| 1.3 | <i>Introduction to buildings:</i> Types of buildings, selection of site for buildings, components of a residential building and their functions.   | CO2                       | 2               |
| 1.4 | <i>Building rules and regulations:</i> Relevance of NBC, KBR & CRZ norms (brief discussion only)   | CO2                       | 1               |
| 1.5 | <i>Building area:</i> Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.  | CO2                       | 1               |
| 2   | <b>Module 2</b>  |                           | <b>Total: 7</b> |
| 2.1 | <i>Surveying:</i> Importance, objectives and principles.   | CO3                       | 1               |
| 2.2 | Bricks: - Classification, properties of good bricks, and tests on bricks   | CO2                       | 1               |
| 2.3 | Stones: - <i>Qualities</i> of good stones, types of stones and their uses.<br>Cement: - Good qualities of cement, types of cement and their uses.  | CO2                       | 1               |
| 2.4 | Sand: - Classification, qualities of good sand and sieve analysis (basics only).<br>Timber: - Characteristics, properties and uses.  | CO2                       | 1               |
| 2.5 | Cement concrete: - Constituent materials, properties and types,<br>Steel: - Steel sections and steel reinforcements, types and uses.   | CO2                       | 1               |

|          |   |     |                 |
|----------|---|-----|-----------------|
| 2.6      | Modern construction materials: - Architectural glass, ceramics, plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials, modern uses of gypsum, pre-fabricated building components (brief discussion only)                                 | CO2 | 2               |
| <b>3</b> | <b>Module 3</b>   |     | <b>Total: 7</b> |
| 3.1      | Foundations: - Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only).<br>Brick masonry: - Header and stretcher bond, English bond & Flemish bond– elevation and plan (one & one and a half brick wall only).<br>Random rubble masonry. | CO2 | 2               |
| 3.2      | Roofs: Functions, types; roofing materials (brief discussion only)<br>Floors: Functions, types; flooring materials (brief discussion only)  | CO2 | 2               |
| 3.3      | <i>Basic infrastructure services:</i> MEP, HVAC, Elevators, escalators and ramps (Civil Engineering aspects only) fire safety for buildings   | CO4 | 2               |
| 3.4      | <i>Green buildings:-</i> Materials, energy systems, water management and environment for green buildings. (brief discussion only)   | CO5 | 1               |
| <b>4</b> | <b>MODULE 4</b>   |     |                 |
| 4.1      | Analysis of thermodynamic cycles: Carnot, Otto, and Diesel cycle- Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net work and efficiency  | 4   |                 |
| 4.2      | IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines, efficiencies of IC Engines(Description only)  | 2   |                 |
| 4.3      | Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines  | 2   |                 |
| <b>5</b> | <b>MODULE 5</b>   |     |                 |
| 5.1      | Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems)   | 1   |                 |
| 5.2      | Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.   | 1   |                 |

|     |   |   |
|-----|---|---|
| 5.3 | Description about working with sketches : Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles) | 4 |
| 5.4 | Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches  | 3 |
| 6   | <b>MODULE 6</b>   |   |
| 6.1 | Manufacturing Process: Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications.   | 2 |
| 6.2 | Metal Joining Processes :List types of welding, Description with sketches of Arc Welding, Soldering and Brazing, and their applications   | 1 |
| 6.3 | Basic Machining operations: Turning, Drilling, Milling and Grinding<br><br>Description about working with block diagrams of: Lathe, Drilling machine, Milling machine, CNC Machine  | 3 |
| 6.4 | Principle of CAD/CAM, Rapid and Additive manufacturing  | 1 |