1. Explain the stress-strain diagram for ductile material and define the following terms:
   (a) Elastic limit
   (b) Yield point
   (c) Ultimate strength
   (d) Gauge length.

2. A copper rod, 25 mm diameter, is enclosed in a steel tube 30 mm internal diameter and 35 mm external diameter. The ends are rigidly attached. This composite bar is 500 mm long and is subjected to an axial tensile load of 30 kN. Find the stresses induced in the rod and tube. Take $E_s = 2 \times 10^5 \text{N/mm}^2$ for steel and $E_c = 1 \times 10^5 \text{N/mm}^2$ for copper.

3. Define the following term:
   (c) Modulus of rigidity (shear modulus)
   (d) Modulus of elasticity
   (e) Bulk modulus of elasticity
   (f) Poisson's ratio.
Q. No. (2) Explain the stress-strain

Rod dim. = 25 mm, Tube dim. = 30 mm (internal)
Tube dim. = 35 mm (external)
Length of bar = 500 mm
Load on composite bar = 30 kN

\[ E_s = 2 \times 10^5 \text{ N/mm}^2 \text{ (for steel)} \]
\[ E_c = 1 \times 10^5 \text{ N/mm}^2 \text{ (for copper)} \]

Rigid support

Composite bar

Let suffix 1 for steel, copper and 2 for steel, tube.

\[ A_1 = \frac{\pi}{4} (25)^2 = 490.9 \text{ mm}^2, \quad A_2 = \frac{\pi}{4} (35^2 - 30^2) = 235.3 \text{ mm}^2 \]

Now \[ P, A_1 + P, A_2 = P = 30000 \text{ N} \] \[ \text{—— (1)} \]

\[ \frac{P_1 L}{E_1} = \frac{P_2 L}{E_2} \quad \text{—— (2)} \]

\[ P_1 = P_2 E_2 \]

\[ P_2 = 0.5 P_1 \]

By eq. (1):

\[ 0.5 P_2 (490.9) + P_2 (235.3) = 30000 \]

By eq. (2) and (3)

From which, we get

\[ P_1 = 29.96 \text{ N/mm}^2 \]
\[ P_2 = 59.92 \text{ N/mm}^2 \]
Q. No.(1) Draw Mohr Circle diagram for an element under stress as shown in fig(1). Show P₁ & P₂ on Mohr Circle.

Q. No.(2) On an element there are two normal stresses 50 N/mm² (tensile) along x-axis and 30 N/mm² (tensile) along y-axis respectively, along with shear stress of 25 N/mm². Find the major and minor principal stresses.

Q. No.(3) Draw B.M.D. & S.F.D. for a simply supported beam as shown in fig(2).
Q. No. (1)

Diagram showing forces and moments.

**Solution**

Assuming \( P_1 > P_2 \)

\[ \sigma_1 = \frac{P_1 + P_2}{2} + \sqrt{\left(\frac{P_1 - P_2}{2}\right)^2 + 25^2} \]

\[ \sigma_1 = 61.9 \text{ N/mm}^2 \]

**Minor principal stress**

\[ \sigma_2 = \frac{P_1 + P_2}{2} - \sqrt{\left(\frac{P_1 - P_2}{2}\right)^2 + 25^2} \]

\[ \sigma_2 = 13.1 \text{ N/mm}^2 \]

Q. No. (2)

**Major principal stress**

\[ \sigma_1 = \frac{P_1 + P_2}{2} + \sqrt{\left(\frac{P_1 - P_2}{2}\right)^2 + 25^2} \]

\[ \sigma_1 = \frac{50 + 30}{2} + \sqrt{\left(\frac{50 - 30}{2}\right)^2 + 25^2} \]

\[ \sigma_1 = 61.9 \text{ N/mm}^2 \]

**Minor principal stress**

\[ \sigma_2 = \frac{P_1 + P_2}{2} - \sqrt{\left(\frac{P_1 - P_2}{2}\right)^2 + 25^2} \]

\[ \sigma_2 = \frac{50 + 30}{2} - \sqrt{\left(\frac{50 - 30}{2}\right)^2 + 25^2} \]

\[ \sigma_2 = 13.1 \text{ N/mm}^2 \]

Q. No. (3)

**Reactions at support**

\[ R_A + R_B = 4 + 4 + 2 \times 2 = 10 \]

**Moments** about \( 'A' \)

\[ 1 \times 1 + 4 \times 3 + 4 \times 5 = 6R_B \]

\[ R_B = \frac{3 \times 6}{5} = 3.6 \text{ KN} \]

\[ R_B = 3.5 \text{ KN} \]

**Moments**

\[ F_A = 3.5 \text{ KN}, F_C = 3.5, F_E = 2.5, F_D = 2.5 \]

\[ F_E = -1.5, F_F = -1.5, F_B = -5.5 \]

**B. M.**

\[ M_A = 0, M_C = 3.5, M_D = 6 \text{ KN-m} \]

\[ M_E = 7, M_F = 5.5, M_B = 0 \]
Q2. Explain Bourdon Pressure gauge (बाउडन दबाव गायर) with sketch.

Or

Explain Diaphragm Pressure gauge (शायफ्राम दबाव गायर) with sketch.

Q3 A 2m diameter circular plate vertically immersed in water. Determine Total Pressure and Centre of Pressure. (एक 2 मीटर व्यास की गोलाकार प्लेट पानी में उत्सर्जन क्रूर हुई है। प्लेट की ऊपरी सतह पानी के सतह पूर्णतः से 2.5 गीते है। प्लेट पर कुल दबाव व दबाव केंद्र ज्ञात करें।)

Q4 A liquid having a volume of 8m³ and mass 4000 Kg. Then calculate the specific weight, Density and Specific gravity. (किसी द्रव का आयतन 8 m³ एवं भार 4000 किग्रा है। तो इसका आपेक्षिक भार, धनत्व और आपेक्षिक चाल ज्ञात करें।)
\[ \text{Solution First Class Test} \]

**Subject code : ME 202**

\[ \text{(a)} \Rightarrow \frac{8 \times 3.14 \times 3.5}{2} \]

\[ \begin{align*} D &= 2 \text{m} \\
\bar{x} &= 2.5 + \frac{1}{2} = 3.5 \text{ m} \\
A &= \frac{\pi}{4} \times 2^2 = 3.14 \text{ m}^2 \\
\rho &= \frac{W}{A \bar{x}} \\
W &= 9810 \times 3.14 \times 3.5 \\
W &= 107811.9 \ \text{N} \Rightarrow 107811.9 \ \text{KN} \\
\overline{h} &= \overline{x} + \frac{I_a}{A \bar{x}} \\
I_a &= \frac{\pi}{64} \Rightarrow \frac{\pi}{64} \times (2)^4 = 0.785 \text{ m}^4 \\
\overline{h} &= 3.5 + \frac{0.785}{3.14 \times 3.5} = 3.571 \text{ m} \\
\text{(b)} \Rightarrow \frac{8 \times 3.14 \times 3.5}{2} \]

\[ \begin{align*} V &= 8 \text{ m}^3 \\
\text{mass} &= m = 4400 \text{ kg} \\
\rho &= \frac{\text{mass}}{\text{volume}} = \frac{4400}{8} = 550 \text{ kg/m}^3 \\
\text{Specific weight (}\rho_s\text{)} &= \frac{\text{Weight}}{\text{Volume}} = \frac{\text{mass} \times g}{\text{Volume}} \\
\rho_s &= \frac{4400 \times 9.81}{8} = 4905 \text{ kg/m}^3 \\
\text{Specific gravity} &= \left( \frac{\rho}{\rho_s} \right) = \frac{500}{1000} = 0.5 \\
\end{align*} \]
II CLASS TEST
CODE:- ME202(F.M.)
M.M=15
TIME 1 HOURS

ATTEMPT ANY THREE QUESTION

(i) PATH LINE AND STREAM LINE पथ रेखा व धारा रेखा
(ii) CONTINUITY EQUATION सांतत्य समीकरण
(iii) BERNOUlli’S THEORM बरनोली प्रमेय
(iv) STEADY AND UNSTEADY FLOW अविस्थत व परिवर्त वाह
(v) UNIFORM AND NONUNIFORM FLOW समान व असमान प्रवाह

प्र 1 निम्न को समझाएँ (DEFINE THE FOLLOWING)

प्र 2 द्रवीय संचायक (HYDRAULIC ACCUMULATOR) या द्रवीय तिफ़रक (HYDRAULIC INTENSIFIER) का सचिवत वर्णन करो।

प्र 3 ओरिफिस को परिभाषित कीजिए एवं उनका वर्गीकरण कीजिए। (DEFINE ORIFICE AND CLASSIFY THEM)

प्र 4 250 मीटर लंबे टेपर पाइप से 100 l/sec की दर से प्रवाहित हो रहा है। पाइप के बड़े सिरे का व्यास 40 सेमी. तथा छोटे सिरे का व्यास 30 सेमी. है। पाइप न्याय तत्से 2 मी. ऊपर कैडिज लगा है। यदि छोटे सिरे पर दब ऑर 1.0 बार है तो बड़े सिरे पर दब की गणना करो। (Water at a rate of 100 l/sec is flowing through 250 m long taper pipe. Diameter of larger end is 40 cm and smaller end is 30 cm. Pipe is Horizontal and 2 meter above the datum line. If pressure at smaller end is 1.0 bar then calculate the pressure at larger end.)
\[ \frac{P_1}{\rho g} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{V_2^2}{2g} + z_2 \]

\[ P_2 = 1 \text{ bar} = 1 \times 10^5 \text{ N/m}^2 \]

\[ Q = 100 \text{ l/sec} = 100 \times 10^{-3} \text{ m}^3/\text{sec} \]

\[ w = 9810 \text{ N/m}^3 \]

\[ \frac{P_1}{\rho g} + \frac{V_1^2}{2g} + 2 = \frac{10^5}{9810} + \frac{V_2^2}{2g} + 2 \]

\[ Q = A_1 V_1 = A_2 V_2 \]

\[ A_1 = \frac{k}{u} x d_1^2 = \frac{k}{u} x \cdot 4^2 = 1256 \text{ m}^2 \]

\[ A_2 = \frac{k}{u} x d_2^2 = \frac{k}{u} x \cdot 3^2 = 7065 \text{ m}^2 \]

\[ A_1 = 1 = 1256 \times V_1 \Rightarrow V_1 = 0.796 \text{ m/sec} \]

\[ V_2 = 1.415 \text{ m/sec} \]

\[ \frac{P_1}{9810} + \frac{(0.796)^2}{2 \times 9.81} = \frac{10^5}{9810} + \frac{(1.415)^2}{2 \times 9.81} \]

\[ P_1 = (10.286 - 0.03) \times 9810 = 100650 \text{ N/m}^2 \]
Q.1 Explain & define the following alloys:
   (a) Steel
   (b) Brass

Q.2 Write the different methods of identification of metals. Explain sound test in detail.

Q.3 Write the formula & s.I units of the following physical quantities:
   (a) $u$
   (b) $a$
   (c) $w$
   (d) $p$
   (e) $s$
II Test Paper

ME-203

Subject: Engineering Materials & Processes

Q.1. Explain Blast furnace with neat diagram. — 5

Q.2. Explain Cupola furnace with neat diagram. — 5

Q.3. Differentiate Steel & C.I. — 2

Q.4. Write the formula & S.I. unit of the following physical quantities:

(a)  s
(b)  w
(c)  a

— 3
Attempt all questions

Q1. Define Link, Mechanism & Machine?

Q2. Define and classify Kinematic Pair? Or Find velocity and acceleration of piston by analytical method?

Q3. Explain Whitworth quick return mechanism with the help of neat sketch? Or Explain crank & slotted lever quick return mechanism with the help of neat sketch?
Attempt any three questions. Each question carries equal marks
Q1. Derive an expression for driving tensions in flat belt drive?
Q2. Draw and explain working of Single plate clutch?
Q3. Explain fluctuation of energy and fluctuation of speed; also write the expressions for coefficient of fluctuation of energy ($C_E$) & speed ($C_s$)? What is the function of a fly-wheel?
Q4. Derive an expression for frictional torque in trapezoidal (truncated cone) pivot bearing considering uniform pressure theory?
1st test ME 206

Basic Automobile Engg.

Q.1. Classify the automobile on the basis of
   
   (a) Fitting of Engine
   
   (b) Fuel used

Q.2. Describe main components mounted on a Chasis and write their functions.

Q.3. What are the main accessories required for an automobile vehicle.
Q1. Classify the brakes on the basis of following:
(a) Purpose (b) Location (c) Construction
(d) Method of Actuation.

Q2. Describe working of tandem hydraulic Master cylinder with help of diagram.

Q3. Describe essential characteristics required of a Braking Fluid.
1) Explain (Any Two)
   (1) X-OR gate  (2) NAND gate  (3) OR gate

2) Describe the Construction of D.C. generator with diagram.

3) Conversion
   (1) \( (011001101)_2 \rightarrow (?)_8 \\
   (2) \( (765)_8 \rightarrow (?)_{10} \\
   (3) \( (132)_{10} \rightarrow (?)_2 \\
   (4) \( (5FB2)_{16} \rightarrow (?)_2 \\
   (5) \( (37.35)_{8} \rightarrow (?)_2 \\

(1) \[ \begin{array}{c|c|c|c} \hline 3 & 1 & 5 \\ \hline \end{array} \]
\[ = (315)_8 \]

(2) \[(765)_8 \rightarrow (\ ?)_{10} \]
\[ = 7 \times 8^2 + 6 \times 8 + 5 \times 8^0 \]
\[ = (501)_{10} \]

(3) \[(132)_{10} \rightarrow (\ ?)_8 \]

(4) \[(5FB2)_{16} \rightarrow (\ ?)_2 \]
\[ \begin{array}{c|c|c|c|c} \hline 2 & 1 & 3 & 2 \\ \hline 6 & 6 & 0 \\ 3 & 3 & 0 \\ 1 & 6 & 1 \\ 8 & 0 \\ 4 & 0 \\ 2 & 0 \\ 1 & 0 \\ \hline \end{array} \]
\[ = (10000100)_2 \]

(5) \[(3735)_8 \rightarrow (\ ?)_2 \]
\[ \begin{array}{c|c|c} \hline 3 & 7 & 35 \\ \hline 0 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \\ \hline \end{array} \]
\[ = (0111111.011101)_{2} \]
1. Write Short Note (Any 2)
   (1) Eddy Current Losses
   (2) Hysteresis Losses
   (3) Copper Losses
2. Explain working & Construction of Transformer
3. Explain (Any 2)
   (1) SCR    (2) DIAC    (3) TRIAC
ME 208: Thermodynamics & IC Engines

Time: 1HR  CLASS TEST-1 (2017-18)  MM: 15

Q.1 Explain the following: (i) scavenging (ii) intensive property
(iii) Zeroth law of Thermodynamics (iv) Control Volume
(v) swept volume (vi) fluid (vii) Compression ratio. (7)

Q.2 Explain the working of a 2-stroke crankcase scavenged petrol engine with a sketch. Compare it with a 4-stroke engine of same size. Which engine will you prefer to buy. (4)

Q.3 State the 1st law of TDS for a system undergoing a process & cycle. Derive & explain the law of conservation of energy from it. (4)
Q.1  Explain the following : (i) brake specific fuel consumption (ii) friction power (iii) SFEE for boiler (iv) throttling (v) CLAUSIUS statement of 2nd law of TDS. (5)

Q.2  A closed system consisting 1 kg of ideal gas undergoes a polytropic process. Find the work exchanged by gas in terms of temperature during this process. (5)

Q.3  An inventor claims that his heat engine develops 5 kW while receiving 0.3 MJ/min of heat. Comment on the validity of his engine based upon a) 1st law & b) 2nd law of TDS. (5)
SOLUTION TO QUESTION (3).

Q. (3)

Ans. Given: \( W = 5 \text{ kW} \)

\[
Q_s = 0.3 \text{ mJ} = 0.3 \times 10^3 \text{ J/min} = \frac{5 \text{ kW}}{60} = 5 \text{ kW}
\]

a) 1st law analysis: \( W_{cycle} = Q_{cycle} \)

Here \( W = 5 \text{ kW} \) and \( Q_s = 5 \text{ kW} \)

\[
\therefore W = Q_s = 5 \text{ kW}
\]

\[\Rightarrow W_{cycle} = Q_{cycle} = 5 \text{ kW} \]

This engine is VALID as per 1st law.

b) 2nd law analysis: \( \eta_{th} = \frac{W}{Q_s} = \frac{5}{5} = 1 \)

\[
\therefore \eta_{th} = 100 \%
\]

\[
\therefore \text{No heat engine can have } 100 \% \text{ thermal efficiency as per Kelvin Planck's statement of 2nd law of TDS}
\]

\[\therefore \text{this engine is IMPOSSIBLE as per 2nd law.}\]
I Test ME209 Session 2017-18

Time: 1 Hour

Maximum Marks: 15

1. Draw neat sketch of center lathe machine and its parts. Describe Centering, Turning and Taper turning processes.

2. Draw single point cutting tool geometry diagram and show different angles and parts of the tool. What is orthogonal and oblique cutting explain.

3. What are basic elements of cutting? Explain different types of chips formed in machining process.
II Test ME209 Session 2017-18
Time: 1 Hour  Maximum Marks: 15

1. Draw neat sketch of shaper machine and its parts. How quick return is achieved in shaper machine.

2. Write short note on:
   a. Vernier caliper
   b. Micro meter
   c. Bevel Protector
   d. Auto-Collimator
   e. Clinometer
Clent. Polytectnic College Chittorgarh  
Session - 2017-18 First Test  
class - II Yr. Mechanical / Electronics  
sub: - C programming (EL/ME 210)  
Max Marks -15 Time - 1 hr.  

Note: - Attempt any three question  
All question carry equal marks.  

0.1. Explain Binary operators.  
0.2. Explain formatted input / output function  
0.3. Explain key words.  
0.4. Explain features of C-language.
Q. 1) Explain 2-D array with example?
Ans -
2-D array:

- Data type name of array [Size1] [Size2];
- Memory of = memory * Size1 * Size2.

Ex - float a[3][5];
60 = 4*3*5

Q. 2) Explain Nested if condition with example?
Ans -
Nested if:

- अगर एक फैला स्टेटमेंट की तलहटी हो तो उसे एक और if-else स्टेटमेंट जोड़ना होता है। हैरान हो जाते हैं।

Ex - if (condition)
  else
    if (condition)
      statement;
    else
      statement;

else की तलहटी हो तो उसे if (condition) की nested if-else statements का use करना होता है।

- अगर एक फैला स्टेटमेंट की तलहटी हो तो उसे एक और if-else स्टेटमेंट जोड़ना होता है।

Ex - if (condition)
  else
    if (condition)
      statement;
    else
      statement;

else की तलहटी हो तो उसे if (condition) की nested if-else statements का use करना होता है।
Q.3) Write a program to find sum of digits of given number?

```c
#include <stdio.h>

Main()
{
    int num, sum, x;
    printf("Enter a number ");
    scanf("%d", &num);
    sum = 0;
    while (num > 0)
    {
        x = num % 10;
        num = num / 10;
        sum = sum + x;
        printf("Sum of digit is %d", sum);
        getch();
    }
}
```

Output:

(Enter a number 1 2 3
Sum of digit is 6)

Q.4) Write a program to print?

```c
#include <stdio.h>

Main()
{
    int i, j;
    i = 1;
    while (i <= 5)
    {
        j = 1;
        while (j <= i)
        {
            printf("%d", j);
            j++;
        }
        i++;
        printf("\n");
        printf("1n");
        getch();
    }
}
```

Output:

```
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
```