Ref. No.: Ex/PE/PC/B/T/224/2025

B.E. POWER ENGINEERING SECOND YEAR SECOND SEMESTER EXAMINATION – 2025

Subject: APPLIED SOLID MECHANICS AND MECHANISMS

Time: 3 Hours **Full Marks: 100**

Different questions of same group are to be answered together.

Group A (CO1)

Answer any two (2) from the following questions.

1. (a) Clarify 'Castiglianos's theorem'.

(b) Derive the expression for Mohr's circle diagram.

(c) If at a point in a body σ_x= 70 MPa, σ_y= 60 MPa and τ_{xy} = -5 MPa then what is the radius of Mohr circle? *5+10+5=20 Marks*

2. (a) Draw the stress-strain diagram for mild steel material and explain.

(b) A steam boiler of 800 mm diameter is made up of 10 mm thick plates. If the boiler is subjected to an internal pressure of 2.5 MPa, find the circumferential and longitudinal stresses induced in the boiler plates

(c) What do you mean by 'principal stress'. *10+5+5=20 Marks*

3. (a) Derive the expression to relate shear force with bending moment.

(b) Draw SFD & BMD for a Cantilever beam subjected to uniformly distributed load.

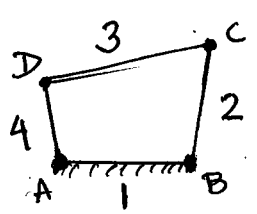
10+10=20 Marks

Group B

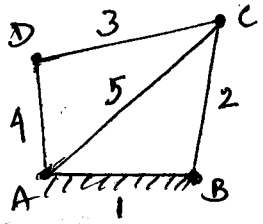
Answer all from the following questions.

4. (a) Explain with diagram of a quick return mechanism for shaping machine.

(b) Find the degree of freedom for the following plane mechanisms.



i) Four bar mechanism



ii) Five bar mechanism

(c) Compare between two kinematic pairs-higher pair and lower pair. ~ CO2

8+6+6=20 Marks

5. Derive the expression for velocity and acceleration of a single slider-crank mechanism.

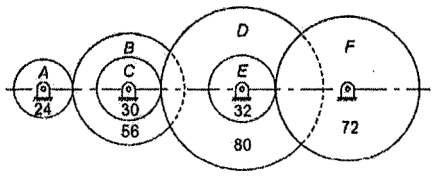
20 Marks

Or. Prove that natural frequency for longitudinal vibration is given by.

$$f_n = \frac{0.4985}{\sqrt{\delta}}$$

where δ is the static deflection of the spring in metres ~ CO3

6. (a) A compound gear train shown in following figure consists of compound gear B-C and D-E. All gears are mounted on parallel shafts. The motor shaft rotating at 800 rpm is connected to the gear A and the output shaft to the gear F. The number of teeth on gears A, B, C, D, E and F are 24, 56, 30, 80, 32 and 72 respectively. Determine the speed of the gear F.



8 Marks

(b) Write short note on the followings. *3 x 4 =12 Marks*

(i) Gear Law

(ii) Module of gear

(iii) Fly wheel ~ CO4