Ref. No.: Ex/PE/PC/B/T/224/2023

B.E. POWER ENGINEERING SECOND YEAR SECOND SEMESTER EXAMINATION – 2023

Subject: APPLIED SOLID MECHANICS AND MECHANISMS

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

Group A

Answer any two (2) from the following questions.

1. (a) Define principal stress.

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

(c) If at a point in a body σ_x= 80 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 steel wire of length 4.7 m and cross sectional area 3 x 10^{-5} m^2 stretches by the same amount as copper wire as 3.5 m length and cross sectional area of 4 x10^{-5} m^2 under a given load. What is the ratio of the Young's modulus of steel to that of copper?

10+10=20 Marks

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

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

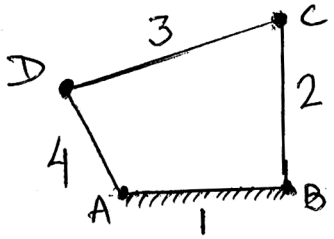
10+10=20 Marks

Group B

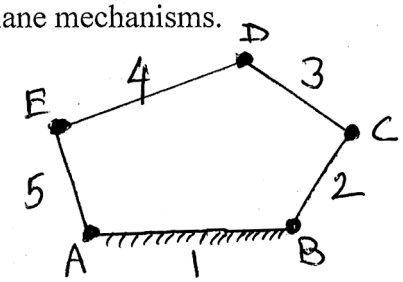
Answer all from the following questions.

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

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



(a) Four bar mechanism



(b) Five bar mechanism

[Turn over

(c) What is the difference between higher pair and lower pair?

8+6+6=20 Marks

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

20 Marks

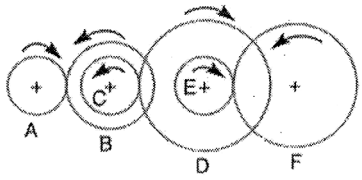
Or. Prove that natural frequency for longitudinal vibration is given by.

$$f_n = \frac{04985}{\sqrt{\delta}}$$

where δ is the static deflection of the spring in metres

6. (a) The gearing of a machine tool is shown below. The motor shaft is connected to gear A and rotates at 975 rpm. The gear wheels B, C, D and E are fixed to parallel shafts rotating together. The final gear F is fixed on the output shaft. What is the speed of gear F? The numbers of teeth on each gear are as given below.

Gear	A	B	C	D	E	F
No. of teeth	20	50	25	75	26	65



8 Marks

(b) Define the following terms for a gear. *4 x 3 =12 Marks*

(i) Pressure angle (ii) Module (iii) Addendum (iv) Backlash