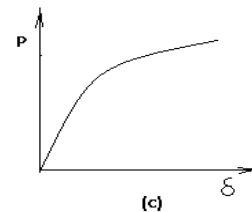
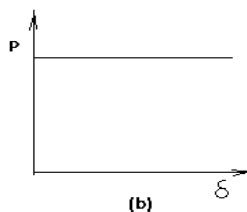
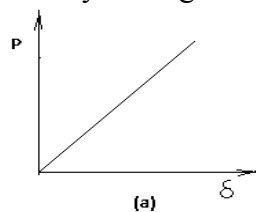


GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-IV • EXAMINATION – WINTER • 2014

Subject Code: 140101**Date: 29-12-2014****Subject Name: Aircraft Structure - I****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) The amount of energy stored in a deformable body up to its elastic limit is referred as _____ and up to failure it is referred as _____. **02**
- (b) The length in a long column in which, effect of buckling is present is called _____. (total length, effective length, slenderness ratio) **02**
- (c) Which of the following represent the correct load-deformation behavior as per Euler's theory of long column? **02**



- (d) The maximum deflection in conjugate beam is observed at a point at which _____. (slope is zero, shear force is zero, bending moment is zero) **02**
- (e) The total number of free displacement in a structure at a joint represents its _____. (Static Indeterminacy, Kinematic Indeterminacy) **02**
- (f) The dam which stored the water is typical example of _____. (Plane stress condition, plain stress condition) **02**
- (g) The stability of _____ structure is higher than that of _____ structure. (Determinate, Indeterminate, deficient). **02**
- Q.2** (a) State and prove Maxwell's Reciprocal Theorem. **07**
- (b) State and prove Moment Area theorems. **07**

OR

- (b) Derive Moment Curvature Relationship of an elastic beam along with suitable assumptions. **07**
- Q.3** (a) In a plain strain problem, we have stress $f_{xx} = 1000$ MPa, $f_{yy} = -50$ MPa, young modulus $E = 200$ GPa and poisson ratio $\mu = 0.3$. Determine the value of stress f_{zz} . **07**
- (b) What is triaxial stress state and plane stress? For an element subjected to plane stress system, derive the maximum and minimum principal stresses and maximum shear stress. **07**

OR

- Q.3** (a) A cantilever beam of a rectangular cross section ($b \times d$) having length "L" is subjected to a point load "F" at free end. Considering the stress function $\phi = Axy + Bxy^3$, investigate the stress field and by satisfying the boundary conditions, obtain the stress distribution in a beam. **07**
- (b) Enlist the common material properties required for aircraft structures. Explain about different materials for aircraft structure. **07**
- Q.4** (a) A 600 mm long steel bar having a rectangular cross section 10 mm x 12 mm is **07**

pin connected at both ends. The bar is laterally restrained along shorter direction at mid length only. Determine the Euler's buckling load. Also draw the final buckle shape of the bar. Take $E = 200 \text{ kN/mm}^2$.

- (b) Find the deflection at point 'C' and 'D' for a beam as shown in fig.-3 using Macaulay's Method. Take $EI = 20000 \text{ kN/m}^2$. 07

OR

- Q.4 (a) A mild steel column has an unsupported length of 3.2 m. It is fixed at base and pin connected at top. The cross section area and the moment of inertia about the minor principal axis are 4324 mm^2 and $4.486 \times 10^6 \text{ mm}^4$ respectively. The yield strength of the material is 250 N/mm^2 . Determine the Rankine Ultimate Load for the column. Take $E = 200 \text{ kN/mm}^2$. 07

- (b) Determine the deflection at free end of a cantilever beam as shown in fig.-2 using any suitable method. Take $EI = 4000 \text{ kN-m}^2$. 07

- Q.5 (a) Analyse the truss as shown in fig.-1, using tension co-efficient method. The direction of a 200 kN force is from E to D. 07

- (b) A simply supported beam having length 10 m is subjected to a downward point load of 20 kN at a distance 6 m from left end support. Determine the rotation at left end support and deflection at the center span of a beam using Double Integration Method. Take $E = 200 \text{ kN/mm}^2$ and $I = 10^9 \text{ mm}^4$. 07

OR

- Q.5 (a) Find the Kinematic Indeterminacy (KI) of a plane frame as shown in Fig.-4, for following cases: 07

- 1-) all beams are of infinite stiffness.
- 2-) columns are vertically inextensible and of infinite stiffness.
- 3-) consider regular frame.

Also determine the static indeterminacy of a frame.

- (b) Calculate the total strain energy stored in a 5 m long cantilever beam subjected to a u.d.l. of 20 kN/m throughout the length. The cross section of a beam is rectangle having dimension $150 \text{ mm} \times 300 \text{ mm}$. Take $E = 200 \text{ kN/mm}^2$ and $G = 80 \text{ kN/mm}^2$. 07

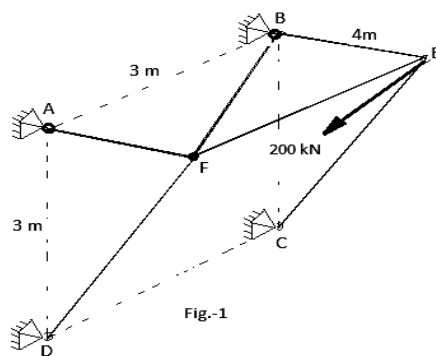


Fig.-1

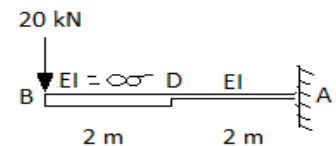


Fig.-2

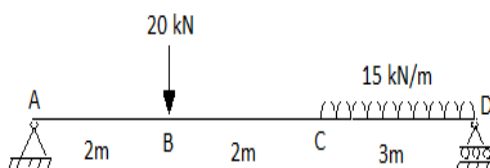


Fig.-3

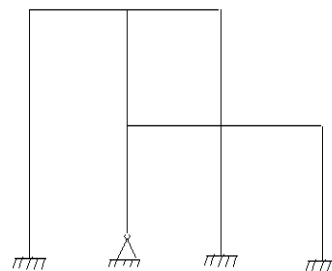


Fig.-4