Printed Pages : 7

ECE-042

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 100757

Roll No.

B. Tech.

(SEM. VII) (ODD SEM.) THEORY EXAMINATION, 2014-15

PLASTIC ANALYSIS OF STRUCTURES

Time : **3** Hours] [Total Marks : **100**

Note : Attempt **all** questions. All questions carry **equal** marks. Assume any suitable data, if missing.

1 Attempt any **four** parts of the following : **5×4=20**

(a) Give an example which illustrates the result of an economical design on the plastic theory ?

(b) Define plastic hinge with an example. What is collapse load ?

(c) For the square beam shown in fig. 1.1 determine the shape factor and fully plastic moment. Take $f_y = 250\ N/mm^2$.

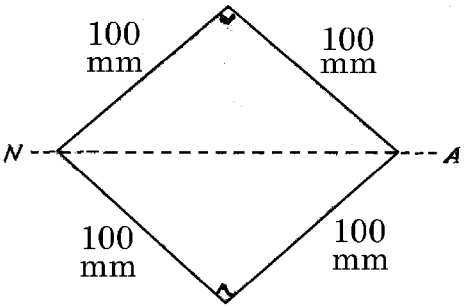

Fig. 1.1.

(d) Discuss the upper bound theorem and lower bound theorem used in the plastic theory.

(e) Establish a relation between load factor and factor of safety.

2 Attempt any **two** parts of the following : **10×2=20**

(a) A propped cantilever ABC is fixed at A and propped at B with an overhang BC. $AB = l$ and $BC = l/3$. The propped cantilever carries a uniformly distributed load over the whole length. Find the collapse load intensity. Also locate the position of plastic hinges at collapse state.

(b) The continuous beam shown in fig. 2.1 is subjected to the collapse load system. Each span has a uniform section. If under the action of the collapse load system, all the spans should collapse. Determine the plastic moment required for each span. Assume that the section for the middle span is the lightest.

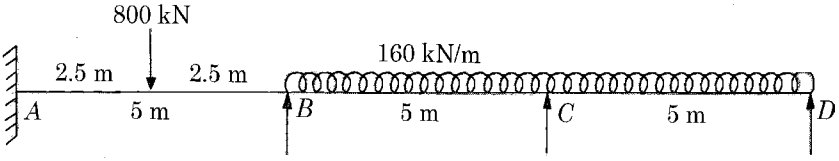

Fig. 2.1.

(c) A rigid beam *ABCD* of length 4 *l* is supported by two vertical steel rods each of area *A* and length *l* and a hinged support at *A* as shown in fig. 2.2. The beam carries a point load *W* at *C*. Find the value of *W*. (i) at first yield and (ii) at collapse.

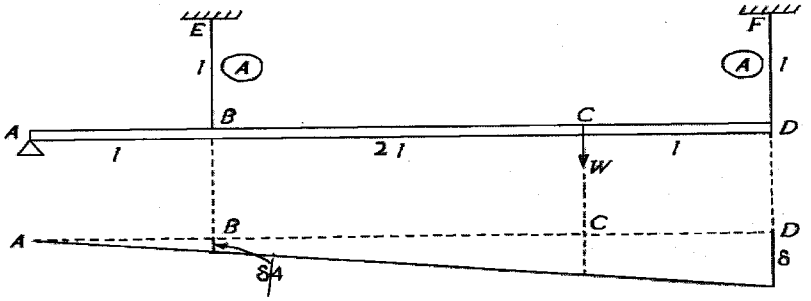

Fig. 2.2.

3 Attempt any **two** parts of the following : **10×2=20**

(a) Explain the semi graphical method for the plastic analysis of portal frames. Also discuss the suitability of this method in which type of portal frames ?

(b) Discuss the mechanism involved in the kinematics method of plastic analysis. For evaluating which parameters, you will use this method. A fixed beam is subjected to an UDL 'w' acting throughout the span of length 'L'. Using the mechanism method, compute the ultimate load.

(c) A two - hinged rectangular portal frame as shown in fig. 3.1 carrying a point load W at mid span and a horizontal sway load 0.5 W. Find the value of W at which the frame will collapse. All the members are of same section.

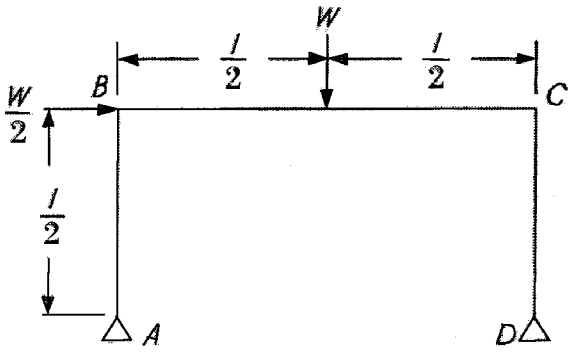

Fig. 3.1.

4 Attempt any **one** of the following : **20×1=20**

(a) Fig. 4.1 shows a two span continuous beam of uniform section having a plastic moment M_p equal to 60 kNm. Determine the collapse mechanism and the load factor. The given loads are working loads.

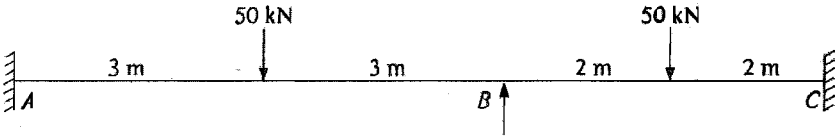

Fig. 4.1.

(b) For the two hinged portal frame loaded as shown in fig. 4.2. Find the value of W at collapse. Assume that the plastic moment of resistance M_p is same for all the members.

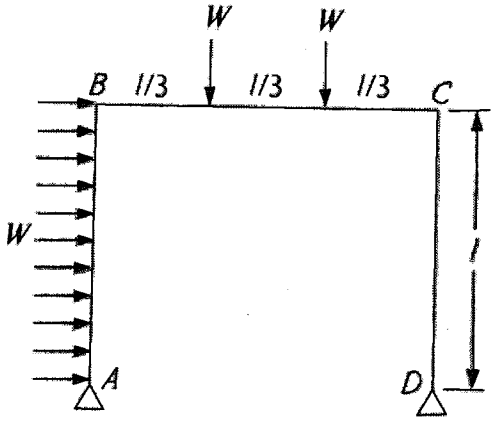

Fig. 4.2.

5 Attempt any **two** parts of the following : **10×2=20**

(a) A continuous beam *ABCD* consists of three equal spans *AB*, *BC* and *CD*, each of length 6 m. The end A is fixed while simple supports are provided at *B*, *C* and *D*. The beam is subjected to the collapse load system shown in Fig. 5.1. Find the plastic moments required for each span, for the condition of simultaneous collapse of all the spans. Assume that the section for the middle span is lighter than the sections of the outer spans.

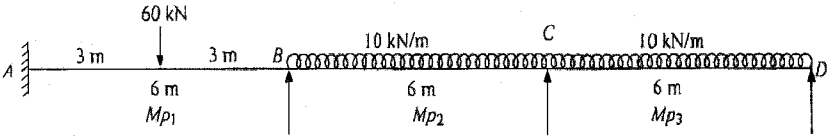

Fig. 5.1.

(b) How the shear will effect the plastic moments during the plastic analysis ? Explain this with the help of the graph between the moment capacity and the shear force or the shear capacity.

(c) Explain, how the plastic moment capacity is affected by the axial forces acts on the structure ? A fixed beam of length 'L' is subjected to a concentrated load 'w' at 'L/4' from one end. Compute the ultimate deflection.