

Structural Analysis Lab Civil Engineering Lab Equipment

BEHAVIOUR OF COLUMN AND STURUTS APPARATUS

Four spring steel columns 15 cm long and .5mm x 1cm in cross section are made and put along a vertical wooden board. These four columns have got different end conditions as below:

- Both ends pinned
- Both ends fixed
- One end pinned and other fixed
- One end fixed and other end free

Load may be applied at the top of these columns increasing gradually. At certain stage of loading the columns show abnormal deflections and give the buckling load. Deflected shapes of the columns may also be traced over the paper fixed on wooden board. Points of deflection can easily be located on the trace. This will give a clear picture of the equivalent length of different types of columns. Load causing buckling can be measured in each case which will illustrate the importance of types of end supports on load bearing capacity of the columns.



ELASTIC PROPERTIES OF DEFLECTED BEAM APPARATUS

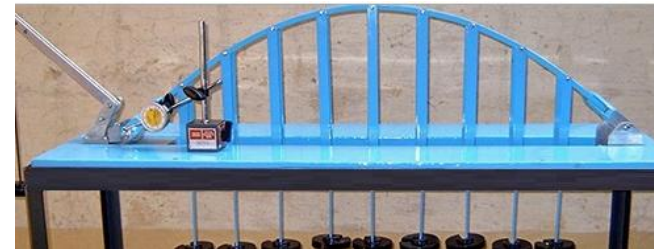
A mild steel beam 2.5 cm x 3 mm in cross section and 100 cm long is pinned to two supports 70 cm apart situated symmetrically. One of the ends can be fixed or given a known slope by applying a known moment at the end with the help of suspended loads. At the other end also a known moment can be applied at various points along the span of the beam. Thus the apparatus can precise be used to determine the various elastic properties of the beam such as EI, Cary over factor, Slopes and deflections.



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TWO HINGED ARCH APPARATUS

The model has a span of 100 cm and rises 25 cm. Both ends are hinged but one of the ends is also free to move longitudinally. Load may be applied at various points equidistant along the horizontal span of the arch. Horizontal movement of one end due to the load can be neutralized by applying a known horizontal inward force with the help of a lever arrangement fitted at this end, thus the horizontal thrust is measured.



THREE HINGED ARCH APPARATUS

The model has a span of 100 cm and rises 25 cm with hinges at supports and crown. One of the ends rests on rollers. Load is applied at various points equidistant along the horizontal span of the arch. This being a statically determinate structure the horizontal thrust developed under the action of any load system can be theoretically calculated & will also be measured directly by neutralizing the outward movement of the roller end. The experiment clearly illustrates the development of horizontal thrust in arches.



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UNSYMMETRICAL BENDING APPARATUS

Angle size 1" x 1" x 1/8" or in equivalent metric units of length 80 cm is tied as a cantilever fixed at one end. Arrangement is provided at the fixed end to rotate the angle such that the principal axes of its cross section may be inclined at any angle with the horizontal and vertical planes arrangement is provided to apply vertical load at the free end of tee cantilever and to measure horizontal and vertical deflection of the free end.



CURVED MEMBER APPARATUS

Steel bar of 2.5 cm x 3 mm is used to make the curved members a circle, semicircle with straight portion a quarter of a circle with straight portion. The bottom ends of the members are fixed to the base, under the application of load at free end, its horizontal and vertical deflection is measured with the help of dial gauge. This will help the students to understand moment area theorem.



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VERIFICATION OF CLERK'S MAXWELL RECIPROCAL THEOREM APPARATUS

Consisting of a beam 100 cm long and 1.25 cm x 4 mm in cross section with graduations every 10 cm along the length, it is supported on two knife edge supports 70 cm apart with a 30 cm over hang on one side. Reciprocal theorem can be verified by direct measurements of the deflection of various points with the help of dial gauge due to a load placed at the reciprocal points.



REDUNDANT JOINT APPARATUS

Three suspension members (spring balances) of different stiffness are jointed at a point to form the redundant joint. The upper end of the suspension members being tied in position to a vertical wooden board arrangement is provided to apply a vertical load at the joint and to measure its horizontal and vertical displacement of a paper and also elongations and forces in the suspension members.



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ELASTICALLY COUPLED BEAM APPARATUS

60 cm long mild steel beam is supported horizontally by 3 suspension rods (spring balances) one at each end and the third in the center. The upper ends of the two outer suspension rods are tied to a vertical wooden board while central suspension rod may be tied to the center of another elastic beam supported at two outlet ends only. Load may be applied at any point of the lower beam and reactions in the suspension rods measured.



DEFLECTION OF TRUSS APPARATUS

The apparatus consists of 4 panels of a PRATT truss each panel being 40 cm horizontally and 30 cm vertically. Load can be applied on each panel point. All tension members are provided with detachable springs so as to obtain appreciable deformation of the member. Direction of diagonal members may be changed. The apparatus can be used to illustrate visually the nature of forces set up in various members of the truss.

