Leicester

E 11(a)

JANUARY 1981

STRENGTH OF MATERIALS AND STRUCTURES N511

(One 3 hour paper)

Note: Derivation of formulae will not be required in the examinations.

1. Forces: Resultant and equilibrant of co-plamer forces. Graphical and analytical solutions for three or more forces.

2. Stress, strain and factor of safety: Tensile, compressive and shear stress and strain. Hooke's law; modulus of elasticity. Factor of safety.

3. Simple framed structures: Determination of stress in members, graphical solutions only.

4. Thin cylinders and riveted joints: Stresses in thin cylinders subjected to internal pressure; single and double riv ted lap and butt joints; efficiency of joints.

5. Shafts: Stress due to torsion; angle of twist; diameters and power for solid and hollow shafting.

6. Strain energy: Strain energy due to tension and compression; resilience; stresses due to suddenly applied loads and falling loads.

7. Loading of beams: Shear force and bending moment diagrams for simply supported and cantilever beams under concentrated and/or uniformly distributed loads. Determination of maximum bending moment and bending moment at any point on the beam.

8. Bending of beams: Section modulus; properties of sections; moments of inertia of rectangular, box, circular, channel, I and T sections and simple built-up sections.

9. Long columns and struts: Euler and Rankine formulae; central loading only. Empirical straight line formula.

10. Simple cases of temperature stress; compound bars.

11. Testing machines, apparatus and methods: Tension, compression and shearing tests. Brinell and Rockwell hardness tests. Izod impact test; fatigue testing; creep; effect of high temperatures; corrosion.

12. The mixing and placing of concrete for general purposes. A general knowledge of the purpose and placing of steel reinforcements in concrete beams, slabs and columns; types of foundations and their applications. (No calculations.).

SEPTEMBER 1981

STRENGTH OF MATERIALS AND STRUCTURES N621

(One 3 hour paper)

Note Derivation of formulae will not be required in the examinations.

1. Pin jointed frames structures: Loads in various members of pin jointed and simple framed structures such as shear legs, jibs and travelling cranes.

2. Thick cylinders: Stresses in thick cylinders under internal and external pressures. Application of Lame's formulae. Force and shrink fits.

3. Combined bending and twisting as applied to solid and hollow shafts; diameters and power transmitted.

4. Theory of bending: Revision of bending moment and shear force; second moment of sections and section moduli; properties of sections and use of standard tables of section properties. More difficult problems on moment of inertia. Eccentric loads on short columns.

   Deflection of:

   (i) cantilevers with uniformly distributed load and a concentrated load, and

   (ii) simply supported beams with uniformly distributed load and a central concentrated load.

   The advantages of built in and continuous beams as compared to the simply supported beam (descriptive only.)

5. The strength and the testing of ropes, chains and attachments used in lifting gear.

6. Sag and tension in wire ropes and chains supported from horizontal points.

7. The mixing and placing of both mass and reinforced concrete. The general design features of rectangular and T beams, slabs and columns and the purpose of reinforcement. Details of construction and use of timber and steel for forms and shuttering.

   Theoretical treatment of reinforced concrete beams of rectangular section with tension reinforcement, reinforced concrete slabs treated as beams.

8. The details and construction of brick, concrete and masonry structures, including storage bins and their supports and retaining walls subjected to earth or water pressure.

9. The types of foundations and their application and construction in various types of ground. A knowledge of bearing pressures and methods of testing ground. Foundations should include grillage foundations, illustrations, descriptions and calculations. Only a basic knowledge of soil mechanics and testing is required.

10. Organisation, inspection and estimates of quantities on construction work. Costing, estimating and quantity surveying should be done at a basic level, as applicable to sections 7, 8 and 9 above.