

- (b) Those who have obtained a senior free place by recommendation, having reached the pass standard in the subjects trade drawing, freehand and instrumental drawing, mathematics or alternative mathematics, general experimental science, and metalwork.

#### SYLLABUS OF PRELIMINARY EXAMINATION.

##### 1. *Drawing.*

(a) *Geometry.*—The substance of Drawing II, Instrumental, as prescribed for the intermediate examination, to a slightly lower standard. Use and care of drawing-instruments, including scales, pencils, pens, compasses, dividers, protractors, set-squares, and T square. How to test the accuracy of drawing-instruments, and how to correct errors. Hand sketching in plan, elevation, and section.

(b) *Freehand Sketching.*—Making approximately accurate hand-sketches of simple geometrical solids and of objects such as tools and simple machine-parts; conventional representation of screw threads.

(c) *Mechanical Drawing.*—Drawing to scale in pencil from dimensioned sketches of parts specified in (b) above. Skill in mechanical drawing will be regarded as of secondary importance compared to skill in free-hand sketching, and questions will not be set in the written examination which involve accurate scale drawings of machine parts. Each candidate will be required to forward his portfolio of drawings to the Director for inspection.

##### 2. *Calculations and Graphs.*

(a) Advantages and disadvantages of fractional and decimal methods of calculation. Idea of accuracy of calculated results. The metric system.

(b) Mensuration of areas and volumes as prescribed for the intermediate examination. Mid-ordinate method for finding area of plane curvilinear figures. Methods of finding weights of typical sections of iron and steel.

(c) Ideas of variable and variability; formulæ. Use of algebraic symbols and logarithms, where advisable, in evaluating simple formulæ. A knowledge of algebraical operations sufficient to change the dependent variable in formulæ.

(d) The straight-line graph and its uses. Use of curvilinear graphs to obtain continuous values of one variable in terms of the other.

(e) In all calculations economy of labour and neatness of setting-out are to be emphasized. Particularly will it be insisted on that "rough checks" of calculations must be made, and that no calculations may be carried past the point where the data cease to be reliable.

##### 3. *Mechanics and Physics.*

Units of force and work.

Principle of work, leading to elementary treatment of parallel forces, levers, moments, compound and Weston's pulley-blocks, inclined plane, screw and worm wheel. Triangle of forces.

Elements of physics and chemistry.

#### SYLLABUS OF INTERMEDIATE EXAMINATION.

##### 1. *Design.*

(a) *Elements of Design.*—Including mechanical drawing, elementary strength of materials, and mechanism as applied to the design of details of machines, &c.

Machine drawing to scale, plans, elevations, sections, dimensioning, &c.

Descriptive work, sketches showing construction and sections of elementary parts of machinery. Fastenings (keys, taper pins, rivets, &c.); shaft-couplings, bearings, hangers, brackets; pulleys (including split pulleys); belts and belt-fastenings; screw threads, single and multiple, of various sections; Whitworth and British fine standard threads; nuts and lock-nuts.

(b) *Statics, Dynamics, &c.*—Simple statics and dynamics, including the simple machines, acceleration and angular acceleration, speeds of machines controlled by belts and gearing, work, energy, power, power-transmission. Friction and lubrication. Moment of inertia and radius of gyration, energy of rotating bodies. Elementary strength of materials.

(c) *Mechanism.*—Cone pulleys. Cams, gearing (trains, epicyclics, tooth shapes, worms and worm wheels), the slider-crank chain, and an elementary treatment of the transmission of motion, including simple calculations of velocity ratios.

##### 2. *Applied Mechanics.*

The application of the principles of statics, &c., learned in the preliminary course to an elementary treatment of the mechanics of machinery.