

Calculus.—Further rules of differentiation ; application to expansion in a series ; theorems of McLaurin and Taylor ; integration of simple functions ; graphical methods of integration of simple functions ; Simpson's rule ; integration by parts and by expansion in a series.

Mathematics II

Co-ordinate Geometry.—Equations of tangents and normals to a given curve (by use of differentiation). Curvature and radius of curvature (with derived formula). The properties of the cycloid, involute, and catenary curves with practical application.

Trigonometry.—Hyperbolic functions ; inverse hyperbolic functions ; relationship to circular and logarithmic functions ; application of De Moivre's theorem to trigonometrical series.

Calculus.—Partial differentiation ; application to differentials and approximations. Convergence of series ; Newton's interpolation formula. Applications of integration to arcs, areas, surfaces, volumes, moment of inertia, radii of gyration, centroids and centres of gravity, mean values, and root mean squares.

Fourier's series.

Differential equations ; simple linear of first and second order ; formation of differential equations from given conditions.

Distribution of errors ; Gaussian law.

Physical Metallurgy (a)

Iron and Steel.—The production of pig-iron from its ores. Different types of pig-irons. The requirements of a satisfactory foundry practice, with particular reference to melting. Ladle additions. The effect of silicon and other alloying elements on cast iron. High-duty cast irons. The production of low-carbon steels by Bessener, open hearth and electric furnace methods. Rolling-mill practice. Forging and other hot working processes.

Elementary consideration of the structure of metals. Crystals, grains, grain size. Thermal equilibrium diagrams. Eutectics, solid solutions, phase change, binary alloys. The iron-carbon equilibrium diagram. Mechanical properties of the ferrous metals. Physical testing machines and procedure.

A candidate in this subject will be required to present a certificate from the Principal of the institution attended that he has carried out a course of practical work of at least thirty hours' duration based on the above prescription and that his attendance and work have been satisfactory.

Physical Metallurgy (b)

Further consideration of the structure of metals. Microphotography and interpretation of results. Plasticity, creep, fatigue, and corrosion.

The effect of alloying elements in the iron-carbon alloys. Classification and uses of alloy steels. The heat treatment of steel. Carburizing and nitriding.

The more common alloys of copper, tin, zinc, nickel, aluminium, and magnesium. Binary and tertiary alloys. Heat treatment, ageing.

Foundry practice for ferrous and non-ferrous materials. Foundry sands. Die-casting, precision investment casting. Powder metallurgy.

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