MECHANICAL ENGINEERING (Code – 15)
Time : 3 Hours
Maximum Marks : 150

Note : Attempt *Five* questions in all. All question carry equal marks. Question No. 1 is compulsory. Answer *Two* questions from part-I and *Two* questions from part-II. The parts of the same question must be answered together and must not be interposed between answers to other questions.

1. Write critical notes on any Four of the followings: **(4 x 7¹/₂ = 30)**
   (a) The inequality of Clausius.
   (b) Merchant's circle diagram.
   (c) Heat treatment of metals.
   (d) Detonation and its effects in I.C. Engines.
   (e) Governor effort and power.
   (f) Characteristic curves of hydraulic turbines.

PART- I

2. (a) The factors that tend to increase detonation in S.I. engine tend to reduce knocking in C.I. engine. Discuss this statement with reference to the following influencing factors- **(15)**
   (i) Compression ratio.
   (ii) Inlet temperature.
   (iii) Self ignition temperature of fuel.
   (iv) Time lag of ignition temperature of fuel.
   (v) Combustion chamber wall temperature.

   (b) Discuss various types of expansion devices used in refrigeration system. **(15)**

3. (a) Explain the followings- **(15)**
   (i) Quick return mechanism for shaper.
   (ii) Automatic feed mechanism of a shaper.

   (b) Discuss various theories of elastic failure in detail. **(15)**

4. (a) Differentiate the followings- **(15)**
   (i) Kinetics and kinematics.
   (ii) Machine and Mechanism.
   (iii) Lower kinematic pair and higher kinematic pair.
   (iv) Absolute and relative motions.
   (v) Mechanism and structure.

   (b) Define inversion of kinematic chain. Also explain various types of inversions of a slider crank mechanism. **(15)**

PART-II

5. (a) Explain in brief, the various defects and imperfections in crystals. **(15)**

(b) Compute the values of maximum and minimum Bending Moment and Shear Force for the simply supported beam loaded as shown in following figure. Draw Bending Moment and Shear Force diagram to scale indicating the significant values along the beam. **(15)**
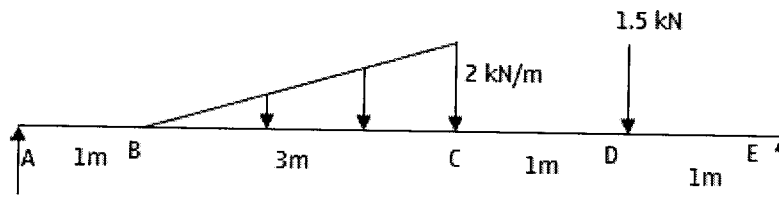
6. (a) During an orthogonal machining operation on mild steel, the results obtained are $t_1 = 0.25$ mm, $t_2 = 0.75$ mm, w = 2.5 mm, $\alpha = 0°$, $F_c = 950$ N, $F_T = 450$ N.
   (i) Determine the coefficient of friction between the tool and the chip.
   (ii) Determine the ultimate shear stress τ_s of the work material. **(15)**

(b) Differentiate condensation and boiling. Also categorise the condensation process according to the behaviour of condensate upon the cooled surface. **(15)**

7. (a) Describe the "Exponential Smoothing method" of sales forecasting with its advantages and limitations. **(15)**

(b) Discuss the necessity and objectives of maintenance. Also describe its classification. **(15)**