8. (a) Explain how psychrometric chart is prepared. Also mention the various properties on this chart. 20

(b) Define the term "By-Pass" factor used for cooling / heating coil and derive the expression for the same. 40

Roll No. ..... **Total No. of Pages : 4**

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Mechanical Engineering

(16)

Paper—II

Time : Three Hours] [Maximum Marks : 300

Note :— (i) Answers must be written in English.

(ii) The number of marks carried by each question are indicated at the end of the question.

(iii) Part/Parts of the same question must be answered together and should not be interposed between answers to other questions.

(iv) The answer to each question or part thereof should begin on a fresh page.

(v) Your answers should be precise and coherent.

(vi) Candidates should attempt Question Nos. **1** and **5** which are compulsory and any **three** out of the remaining questions, selecting at least **one** question from each Section.

(vii) If you encounter any typographical error, please read it as it appears in the text-book.

SECTION–A

1. Answer any **three** of the following :

(a) The work and heat transfer per degree of temperature change for a system executing a non flow process are given by :

$$\frac{dw}{dT} = \frac{1}{30} \text{Kcal/°C} \quad \text{and} \quad \frac{dQ}{dT} = \frac{1}{10} \text{Kcal/°C}$$

Find the change in internal energy of the system as its temperature increases from 125°C to 245°C. 20

(b) (i) Define Mach number. Explain the physical significance of the Mach number. 10

(ii) Derive the momentum equation for the flow taking place over a flat plate. 10

(c) (i) Explain the following terms (i) Black body and Grey body. 10

(ii) State and explain Stefan-Boltzmann Law. 10

(d) Explain the combustion phenomenon in C.I. engine with the help of P–Q diagram. 20

2. (a) Using Buckingham's π theorem, show that the velocity through a circular orifice is given by

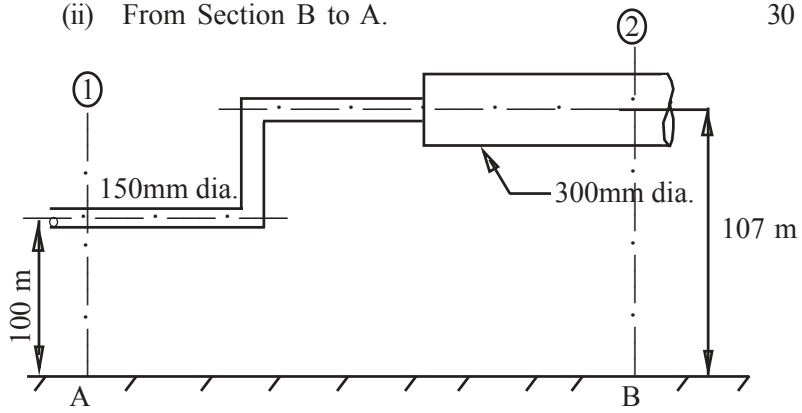
$$V = \sqrt{2gH}\ \phi\left[\frac{D}{H}, \frac{\mu}{\rho \vee H}\right]$$

where H in the head causing flow, D is the diameter of the orifice, μ is the co-efficient of viscosity, ρ is the mass density and g is the acceleration due to gravity. 30

(b) A pipeline is 150mm in diameter and is at an elevation of 100m at section-A. At section-B it is at an elevation of 107m and has a diameter of 300mm. When a discharge of 50L/s of water is passed through this pipe the pressure at section-A is observed to be 30KPa. The energy loss in the pipe is 2m. Calculate the pressure at B when the flow is

(i) From Section A to B

(ii) From Section B to A. 30



3. (a) A series combination of two Carnot engines operate between the temperature of 180ºC and 20ºC. Calculate the intermediate temperature if the engines produce equal amounts of work. 30

(b) Write short note on Reversibility and Efficiency according to the Second Law of Thermodynamics. 15+15

4. (a) For an infinitely long fin with insulated end, with usual notations, Prove that Heat dissipated is given by

$$Q_{fin} = \sqrt{h\,P\,K\,Ac}\cdot\theta_0\cdot\ Fan\,h\,(m.L).$$ 40

(b) Draw the boiling curve for pool boiling of water. Explain the significance of "burnout point" and "Leidenfrost point". 20

SECTION—B

5. Answer any **three** of the following :

(a) What are the advantages of closed cycle over open cycle Gas turbines ? 20

(b) Explain the phenomenon of knocking. 20

(c) Explain the following terms :

(i) Degree of Saturation

(ii) Relative Humidity. 20

(d) What are the factors affecting the flame propagation ? 20

6. (a) Derive an expression for LMTD of a counter flow heat exchanger; state clearly the assumptions. 40

(b) Differentiate between Nucleate boiling and film boiling. Explain the various regimes of pool boiling. 20

7. (a) Write short notes on Solar Energy Sources and analysis of collector performance. 30

(b) Explain any one method for improvement of thermal efficiency of simple open cycle constant pressure Gas Turbine plant with neat sketches. 30