

24008

B. Tech. 2nd Semester Examination, May-2013

BASICS OF MECHANICAL ENGG.

Paper-ME-101-F

Time allowed : 3 hours]

[Maximum marks : 100

Note : Question No. 1 is compulsory. Attempt any five questions in total, by selecting at least one question from each section.

1.
 - (i) Define system, boundary and surrounding.
 - (ii) Why the tension on tight side is greater than that on slack side ?
 - (iii) Define stress, strain and their types.
 - (iv) Write an expression for length of belt in cross belt arrangement.
 - (v) Name inorganic refrigerants and azetrope refrigerants.
 - (vi) Define the terms : degree of saturation and relative humidity
 - (vii) How evaporation differs from boiling ?
 - (viii) How a milling machine is specified ?

8×2.5=20

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Section-A

2. (a) 1.5 kg of nitrogen contained in a cylinder at pressure 6 bar and temperature 300 K expands three times its original volume. Assuming the expansion process to be isobaric make calculations for (i) initial volume (ii) final temperature (iii) work done by gas (iv) heat added and (v) change in internal energy. For nitrogen $c_p = 1.05 \text{ kJ/kg K}$ and $R = 295 \text{ J/kg K}$. 12
- (b) Prove the equivalence between the Kelvin-Planck and Clausius statements of the second law of thermodynamics. 8
3. (a) Draw the neat sketch of a shaping machine. Name the main parts and state the functions of those parts. 14
- (b) Define quality and dryness fraction of steam. 6

Section-B

4. (a) Define the following terms : refrigeration, refrigeration effect, COP of heat pump, ton of refrigeration

Also prove that

$$(\text{COP})_{\text{heat pump}} = 1 + (\text{COP})_{\text{refrigerator}} \quad 12$$

(3)

24008

- (b) What is psychrometric chart ? What information does it provide ? 8
5. Describe with neat sketches the construction and working of :
- (a) Francis turbine
 - (b) Kaplan turbine
 - (c) Reciprocating pump. 20

Section-C

6. (a) Derive expressions for the length of belt in open belt system. 10
- (b) Define circular pitch, diametrical pitch and module in relation to tooth gears. 10
7. (a) Derive the following relations for elastic constants for an isotropic material

(i)
$$E = \frac{9CK}{3K + C}$$

(ii)
$$\mu = \frac{3K - 2C}{6K + 2C}$$
 12

- (b) A tie bar of a foundry wall crane is 2 m long and 4 cm in diameter. Determine the stress and

24008

P.T.O.

extension in the bar when it is subjected to a load of 100 kN. Also find the work done in extending the bar.

Take $E = 200 \text{ GN/m}^2$.

Section-D

8. (a) Explain the difference between open and closed loop system control systems in relation to NC and CNC machine systems. 10
- (b) Draw a neat diagram showing the main elements of a NC machine, and state the function served by each element. 10
9. (a) What are NC and CNC machines ? 10
- (b) List the benefits of having NC and CNC machines in place of conventional machines. 10