MANIPAL ACADEMY of HIGHER EDUCATION
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Question Paper - Report

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MANIPAL ACADEMY OF HIGHER EDUCATION

B.Tech Ist Semester Sessional Examination September 2024

BASIC MECHANICAL ENGINEERING SCIENCE [MIE 1072]

Marks: 30 **Duration: 90 mins.**

MCQ

Answer all the questions. Section Duration: 20 mins

1) Which among the following mountings can be used as a last safety measure to prevent explosion of the boiler

(1)

Fusible plug Safety Valve Pressure gauge Blow-off valve

2) Identify among the following mounting/accessory that can be installed to improve the sensible heat of feed water

(1)

Economiser Superheater Feedcheck valve Air preheater

3) In a belt drive where pulleys are rotating in opposite direction with velocity ratio equal to one, the angle of contact is _____

(1)

Less than π radian | greater than π radian | Equal to π radian | Can be less than or greater than π radian depending on the diameter of the pulleys

4) Match the following: (1)

A. Temperature increases with no phase change	I Amount of superheat
B. Phase change with no increase in temperature	II Critical point
C. Phase changes without evaporation	III Latent heat
D. Temperature increases of vapor with no phase change	IV Sensible heat

A-III; B-II; C-I; D-IV | A-IV; B-III; C-I; D-II | A-IV; B-III; C-II; D-I | A-II; B-I; C-IV; D-III

5) The angle of lap for a belt drive having a driver pulley of 0.25 m radius transmitting power to the driven pulley situated at a distance of 2000 mm rotating at the same speed in an opposite direction is _____ (1)

(π + 0.25) rad | (π + 0.51) rad | (π - 0.25) rad | π rad

DESCRIPTIVE

Answer all the questions.

6) A boiler supplies steam which consists of a mixture of saturated water and saturated steam in the ratio of 1:1 per kg of steam. The pressure of the steam is found to 1.6 N/mm^2. The steam is passed through the superheater to achieve the degree of superheat of 100°C. From the super heater, the steam is led to a pipeline where it loses 20% of its total enthalpy at constant pressure. If the temperature of feed water is 30˚C, determine (4)

a. Heat added to feed water in the boiler

b. Condition and related parameter of the steam at the exit point of pipeline.

7) Compute the power that can be transmitted by a belt drive for a speed reduction ratio of 4.The machine pulley is to rotate in a direction opposite to that of the motor pulley. The diameter of the larger pulley is 200 mm and the motor runs at a speed of 1000 rpm. The coefficient of friction is 0.3 and the pulleys are 4 m apart. The initial tension in the belt drive when stationary is 800 N. (3)

8) Power is transmitted between two shafts which are 2m apart using two pulleys both rotating in counter clockwise direction with a velocity ratio of unity. The length of the belt is 5.571m, speed of the belt is 60 m/s and coefficient of friction is 0.3. Determine the size of the two pulleys and power transmitted, if the initial tension in the belt is 500 N. (3)

9) A food processing industry operating a solid fuel-fired water tube boiler, uses 20% wet steam at a temperature of 130°C. The proprietor has a choice of fuel-1 and fuel-2 having calorific values of 25 MJ/kg and 30 MJ/kg respectively. The boiler has to be operated at an average efficiency of 75%. Determine the mass of both the fuels used per hour if the steam requirement is 500 kg/h using the feed water at a temperature of 25°C. (3)

10)	A group drive is being proposed for a shop floor. Suggest a type of pulley that can help intermittent switching off and on of select machines whenever required without disturbing the working of the rest of the machines. Sketch and explain the working pinciple of the suggested type of pulley.	(3)
11)	A sugar industry is planning to install a coal fired boiler in its plant for process heating. The boiler has to generate 4000 kg/h wet steam which is 10% wet and having a temperature of 188°C. The feed water is drawn from a nearby reservoir at an average temperature of 30°C. The coal consumption required is 2000 kg/h and the calorific value of the coal is 25 MJ/kg. There is an option to use an economiser which raises the temperature of feed water to 85°C and reduces the coal consumption by 12%. Compute the boiler efficiency for both the scenarios.	(3)
12)	A maritime cargo transporter wants to install a boiler on a cargo vessel to produce steam for heating and air conditioning. The boiler will use seawater as feed water. Suggest a suitable type of boiler that doesn't require additional equipment for operation and justify your choice.	(2)
13)	Give reasons for the following: a. Mountings are an integral part of the boiler b. Feed check valves are used instead of regular valves for feeding water to the boiler	(2)
14)	"Friction is helpful for the belt drives to operate". Justify.	(2)

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