Exam Date & Time: 06-May-2024 (09:30 AM - 12:30 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

SECOND SEMESTER B.TECH. EXAMINATIONS - APRIL / MAY 2024 SUBJECT: MIE 1071/MIE_1071 - BASIC MECHANICAL ENGINEERING BASIC MECHANICAL ENGINEERING [MIE 1071-PHY]

Marks: 50

Duration: 180 mins.

A

Answer all the questions.

An industry receives steam from a boiler which makes use of fuel at the rate of 1A) 1000kg/hr to generate 2000kg/hr of dry steam at 1.0 MPa. The feed water supplied to the boiler is at 30°C. The calorific value of fuel used is 42MJ/kg. i) Find the boiler efficiency. ii) If the fuel consumption is to be reduced by 20%, the feed water is preheated by 5°C. If the steam generation rate and steam condition remain the same, what will be the boiler efficiency? (4) iii) For case ii), if the steam is superheated with a DOS of 20°C, then what will be the boiler efficiency? iv) For case iii), what will be the steam generate rate if heat absorbed by steam in the boiler is increased by 10% for the same boiler efficiency and fuel consumption. Assume the specific heat of water as 4.18 kJ/kgK and that of superheated steam as 2.25 kJ/kgK. 1B) 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 and the mass of the steam supplied is 500kg, determine

- Total heat added to feed water in the boiler
- Total heat supplied in the super heater
- Condition of steam at pipeline exit.

Assume the specific heat of water as 4.18 kJ/KgK and that of superheated steam as 2.25 kJ/KgK.

- 1C) Explain the use of feed check valve, steam separator and steam stop valve in steam boiler.
- Calculate the minimum width of the belt required for a crossed belt drive from the following data: Power transmitted = 15 kW, Speed of the driven pulley=1600rpm, Velocity Ratio = 4, driven pulley diameter = 250mm, Centre distance = 2m, Coefficient of friction between the belt and pulley=0.3, Permissible tension per meter width of belt=23 kN. Also find the necessary length of the belt required.
- 2B) Gear A has a module of 2 and 50 teeth, Gear B has a diameter of 201mm and 67 teeth, (3) Gear C has a module of 4 and diameter of 152mm, Gear D has a diameter of 50mm and 25 teeth, Gear E has a module of 3 and 100 teeth, Gear F has a module of 4 and is 350mm in diameter, Gear G has a module of 3 and diameter of 126mm, Gear H has a diameter of 60mm and 30 teeth, Gear I has 55teeth and a diameter of 110mm.Determine

(3)

(3)

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an arrangement to obtain the maximum possible velocity ratio using maximum number of wheels. If the driver gear rotates at 225rpm, determine the speed of the driven shaft.

- 2C) With neat block diagram and labelling, explain the appropriate power transmission system which is used for providing variable rotational speeds at the output shaft. (3)
- 3A) The total clearance volume of a 4 stroke 4 cylinder internal combustion engine is 400cc. Determine the bore and stroke of each cylinder if the two are equal for each cylinder and the compression ratio is 18:1. Also determine power per liter of cylinder stroke volume ⁽⁴⁾ if the total power output of the engine is 72 kW
- 3B) Sketch and explain the working principle of an engine having its crankcase filled with lubricating oil and operating on an isobaric heat addition process. (3)
- 3C) Give reason for the following:
 i) All engine cylinders have clearance volume.
 ii) Petrol engines have smaller compression ratio.
 iii) Diesel engines are bulkier than petrol engines.
- 4A) List and explain the sequence of operations that are to be carried out to turn the following job on a lathe held between centres from a mild steel rod of diameter 28 mm. Sketch not required along with explanation.



All Dimensions are in mm

4B)	For the purpose of assembly using a non-protruding square headed bolt, a non-threaded hole of standard size is to be processed using a drilling machine. Sketch and explain the sequence of operations.	(3)
4C)	List any six industrial applications where robots can be used.	(3)
5A)	Explain any two pattern allowance that require the pattern to be of: i) larger dimension than the final dimension of the casting ii) smaller dimension than the final dimension of the casting	(4)
5B)	Suggest and explain the suitable joining processes that are used for the following scenarios: i) fabrication of electronic printed circuit boards ii) joining dissimilar metals using spelter	(3)
5C)	Discuss the different components that make up an automated system for production systems? Sketch a block diagram of the same.	(3)

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(3)