Exam Date & Time: 06-Dec-2023 (09:30 AM - 12:30 PM)





MANIPAL ACADEMY OF HIGHER EDUCATION

FIRST SEMESTER B.TECH. DEGREE EXAMINATIONS - NOVEMBER/DECEMBER 2023 SUBJECT: MIE 1071 / MIE-1071 - BASIC MECHANICAL ENGINEERING

BASIC MECHANICAL ENGINEERING [MIE 1071]

Marks: 50

Duration: 180 mins.

A

Answer all the questions.

1A) A chemical processing industry uses a water tube boiler which can generate 22% wet steam at 900 kPa. The hourly steam requirement is 780 kg. The feed water is supplied from a nearby reservoir maintained at 28°C. The boiler is fired using wood pellets and coconut shell in a 6:4 mass ratio. The gross calorific value of wood pellets and coconut shell are 19600 kJ/kg and 20800 kJ/kg respectively. Calculate the hourly consumption of wood pellets and coconut shells. The boiler operates with an efficiency of 60%. To improve the efficiency of the boiler, the following options are considered both of which (4)reduce the fuel consumption by 12%: i) Use of an economizer which increases the feed water temperature by 50°C ii) Use of an air preheater which improves the combustion of fuel Suggest the industry regarding which option it has to use to improve the efficiency of the boiler. Justify your suggestion through comparison of boiler efficiencies using the above mentioned accessories. 1310 kg of steam which is 15.75% wet is produced in a boiler at a pressure of 2.5 1B) N/mm². Steam enters the super heater where its temperature is raised such that the degree of superheat is 160°C. From the super heater, the steam is led to a heat exchanger for process heating where it loses 27.2% of enthalpy. If the temperature of feed water is (3)32°C, determine: i) Total heat added to feed water in the boiler ii) Total heat supplied in the super heater iii) Condition and related parameter of the steam at the exit point of heat exchanger 1C) Give reasons for the following: i) Boiler mountings are an integral part of a boiler. (3)ii) Saturated steam cannot be produced in the boiler drum. iii) Water tube boilers generally operate at higher operating pressures. A crusher in a mining setup uses a flat belt drive to transmit power between two parallel 2A) shafts running in opposing directions. The driver pulley, has a diameter of 300 mm, and the output shaft rotates at a speed of 250 rpm. The centre distance between the driver and driven pulleys is 800 mm. The speed reduction ratio is 3/2. Given an initial tension (4)of 1500 N in the belt, determine the tension on the tight and slack side of the belt. Also, determine the power transmitted and compute the length of the belt. Assume coefficient of friction to be 0.28 2B) The power train of a machine consists of a combination of open flat belt drive and a (3)compound gear train. The machine is being driven by a motor running at 1200 rpm. The power is transmitted from the motor to the gear train by a belt drive with a speed reduction ratio of 4. The compound gear train consists of 6 spur gears, A, B, C, D, E and F. The gear train is built in such a way that Gear A meshes with B, C meshes with D

while E meshes with F. Gears B and C are compound gears and so are gears D and E.

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Gear A has 30 teeth with module 3 mm while Gear D with module 2 mm has 126 teeth. Gear E having module 2 mm has 24 teeth. The speed reduction ratios from gear A to B is 2, from C to D it is 3 while from E to F it is 5. Find the number of teeth for gears B, C and F. Also determine the speed at gear F and the centre distance of the gear train. Show the arrangement.	
A machine is being designed in which four different speeds are required. Suggest a suitable system and explain the construction and working of the same with the help of a neat sketch.	(3)
The following data refers to a twin cylinder I C engine cylinder diameter=200mm, Stroke length= 300mm, Total cam shaft revolutions/hour= 18000, Mean effective pressure= 6bar, Fuel consumption= 15litres/hour, Calorific value of the fuel= 45000kJ/kg, Specific gravity of the fuel= 0.8, Determine the indicated thermal efficiency?	(4)
Sketch and explain the working principle of an I C engine fitted with a carburetor and a camshaft.	(3)
Give reasons for the following:i) Four stroke engines are more fuel efficient than two stroke engines.ii) Petrol engine is lighter compared to diesel engineiii) High rate of wear and tear exists for two stroke engines	(3)
With neat sketch, explain any four lathe operations.	(4)
With neat sketch and labelling, explain the features of radial drilling machine.	(3)
Explain the characteristics of additive manufacturing.	(3)
Explain draft and shrinkage allowances used in casting process with neat sketches.	(4)
With neat sketch explain the working of resistance spot welding.	(3)
Explain the limitations of NC machine.	(3)
	ME 1071 Gear A has 30 teeth with module 3 mm while Gear D with module 2 mm has 126 teeth. Gear E having module 2 mm has 24 teeth. The speed reduction ratios from gear A to B is 2, from C to D it is 3 while from E to F it is 5. Find the number of teeth for gears B, C and F. Also determine the speed at gear F and the centre distance of the gear train. Show the arrangement. A machine is being designed in which four different speeds are required. Suggest a suitable system and explain the construction and working of the same with the help of a neat sketch. The following data refers to a twin cylinder I C engine cylinder diameter=200mm, Stroke length= 300mm, Total cam shaft revolutions/hour= 18000, Mean effective pressure= 6bar, Fuel consumption= 15litres/hour, Calorific value of the fuel= 45000kJ/kg, Specific gravity of the fuel= 0.8, Determine the indicated thermal efficiency? Sketch and explain the working principle of an I C engine fitted with a carburetor and a camshaft. Give reasons for the following: i) Four stroke engines are more fuel efficient than two stroke engines. ii) Petrol engine is lighter compared to diesel engine iii) High rate of wear and tear exists for two stroke engines With neat sketch, explain any four lathe operations. With neat sketch and labelling, explain the features of radial drilling machine. Explain the characteristics of additive manufacturing. Explain draft and shrinkage allowances used in casting process with neat sketches. With neat sketch explain the working of resistance spot welding.

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