Exam Date & Time: 16-Jan-2024 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FIRST SEMESTER B.TECH. DEGREE EXAMINATIONS -JANUARY 2024
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 boiler supplies steam at 3 N/mm^2 and 300^oC at 5000 kg/hr. The feed water is supplied at 30^oC. Fuel is supplied at 800kg/hr whose calorific value is 22MJ/kg.
i) Find the boiler efficiency.
ii) If the efficiency of boiler is to be increased by 5% in absolute terms, what should be the ratio of steam generation rate to fuel consumption rate assuming the heat gained by water in the boiler remain same? (4)
iii) If an economiser is used to preheat the feed water by 5^oC and reduce fuel consumption by 5%, what will be the new efficiency?
Assume the specific heat of water as 4.18 kJ/kgK and that of superheated steam as 2.25 kJ/kgK.

1B) 5kg of steam at a pressure of 2bar is supplied to a pipeline at 200^oC. Due to poor insulation, steam loses 2000kJ of heat in the pipeline at constant pressure conditions. The steam coming out of the pipeline is further supplied to a turbine where the steam condition must be superheated with a degree of superheat of 100^oC. What quantity of heat should be supplied to steam at the pipeline exit if the required condition of steam has to be achieved at turbine inlet? Assume the specific heat of superheated steam as 2.25 kJ/KgK. (3)

1C) Explain any three differences between boiler mounting and boiler accessories. (3)

2A) An electric bike makes use of flat open belt drive for power transmission between motor shaft and wheel shaft. The shafts are placed at a centre distance of 500mm. The velocity ratio of the drive is limited to 3. The maximum tension in the belt is found to be 1740 N. The speed and diameter of the driver pulley are 300 rpm and 100 mm respectively. What is the power transmitted by the belt drive? What will be the length of belt? Assume the coefficient of friction between the belt and the pulley surface as 0.3. (4)

2B) The following gear wheels are available to form a compound gear train. Sketch the arrangement of gear train to get maximum velocity ratio using four shafts and calculate (3)

the same. Also mention the conditions used to achieve maximum velocity ratio.

Gear	Type	No. of teeth	Module(mm)
A	Spur	92	2
B	Spur	40	2
C	Spur	30	3
D	Spur	75	3
E	Helical	104	2
F	Helical	40	2
G	Helical	72	3
H	Helical	30	3

2C) List ANY THREE advantages of belt drive system and chain drive system? (3)

3A) A twin cylinder diesel engine admitting charge in to the engine cylinder in an indirect manner has fuel consumption as 0.257 kg/kWh at 25 cycles per second. The calorific value of diesel is 43,900 kJ/kg. The net brake load is 70 kg and the mean circumference of the brake drum is 4m. Determine the brake thermal efficiency of the engine. (4)

3B) Identify and explain the working of an I.C engine which admits the charge in an indirect manner and has a compression ratio of 9. (3)

3C) Justify the following statements:
i) Brake Power cannot be equal or more than Indicated Power
ii) Two stroke engines do not need a cam shaft
iii) Heavier flywheel is used in 4 stroke engines. (3)

4A) Identify and hence explain the lathe operations for the following with neat sketches
i) Removal of sharp corners on shaft ends
ii) To get serrated surface which helps in effective gripping (4)

4B) Compare the following drilling operations with the help of neat sketches: Reaming and Boring (3)

4C) Why additive manufacturing is called so? List the steps involved in making of parts using this technique. (3)

5A) Explain the significance of the following moulding sand properties
i) Permeability
ii) Flowability
iii) Cohesiveness
iv) Refractoriness (4)

5B) Suggest a suitable welding process that makes use of a non-consumable electrode and facilitates joining of dissimilar metals. (3)

5C) What advantages do you see with installation of CNC machines on a shop floor? List any 6 points. (3)

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