BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BTECH/IMSC **SEMESTER : II**
BRANCH: MECH/CIVIL/PIE/CHEMICAL/BIOTECH/FT/PHYSICS **SESSION : SP/2024**

SUBJECT: ME101 BASICS OF MECHANICAL ENGINEERING

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Discuss the transformation of a determinate truss into an indeterminate one, accompanied by mathematical reasoning. Additionally, illustrate the process with appropriate diagrams.	[4]	1	2
Q.1(b)	A circular steel rod ABCD of different cross-sections is loaded as shown in Fig. 1. Find the maximum stress induced in the rod and its deformation. Take E = 200 GPa.	[6]	1	1

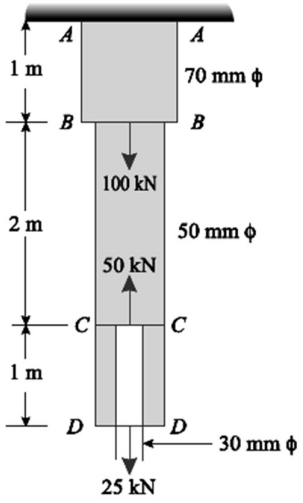

Fig. 1

Q.2(a)	Why does d'Alembert's principle remain relevant in dynamic problem analysis despite the sufficiency of Newton's second law?	[4]	2	2
Q.2(b)	The disk is released from rest and rolls down the incline as shown in Fig. 2. Knowing that the speed of A is 1.2 m/s when θ=0°, determine at that instant (a) the angular velocity of the rod, (b) the velocity of B. Only portions of the two tracks are shown.	[6]	2	1

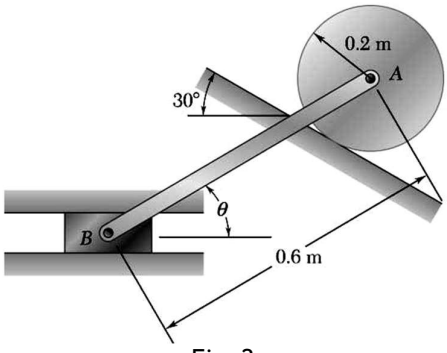

Fig. 2

PTO

Q.3(a)	How would the absence of friction impact life sustainability? Support your answer with examples from established mechanical systems.	[4]	3	2
Q.3(b)	A 13.6-kg block is supported by the spring arrangement shown in Fig. 3. If the block is moved from its equilibrium position 44 mm vertically downward and released, determine the period and frequency of the resulting motion.	[6]	3	1

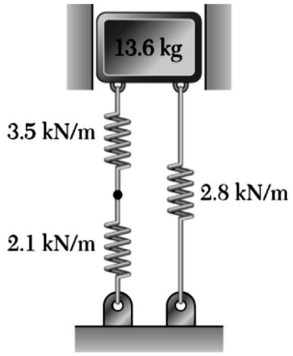

Fig. 3

Q.4(a)	The boiler aims to generate steam. Then can we classify a kettle as a boiler? Justify your answer with a detailed explanation.	[4]	4	3
Q.4(b)	Explain how boilers contribute to power generation in a plant, accompanied by a labeled diagram of a boiler.	[6]	4	1

Q.5(a)	Propose sustainable strategies for reducing fossil fuel consumption on your Institute campus through renewable energy utilization and justify your selection of a renewable energy source based on its potential impact and feasibility.	[4]	5	3
Q.5(b)	Explain in detail the harnessing process of your chosen, as mentioned in Q.5(a), renewable energy source.	[6]	5	1

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