MANIPAL INSTITUTE OF TECHNOLOGY
BENGALURU
(A constituent unit of MAHE, Manipal)

I semester MIDTERM TEST

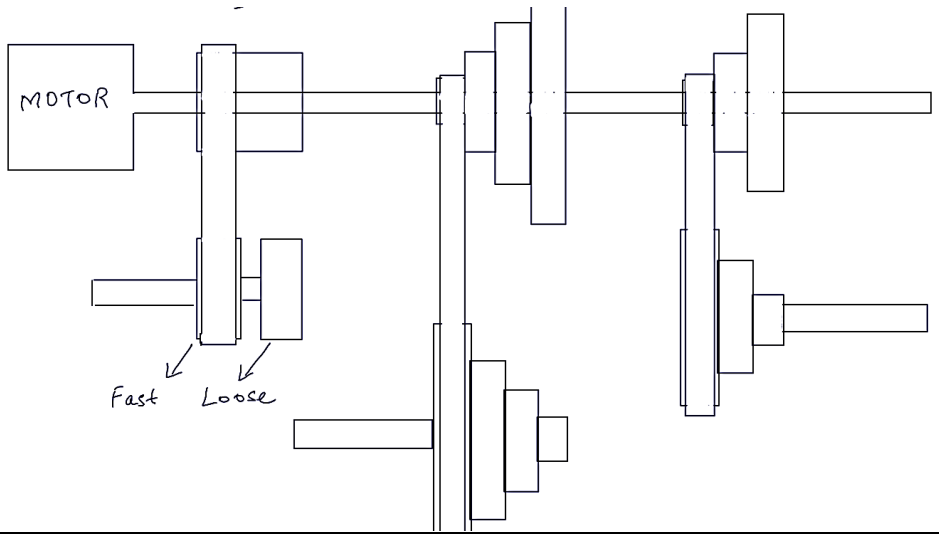
Basic Mechanical Engineering (MIE_1071)

Time Duration: 2 Hours **Date: 22/10/2024** **Max marks: 30 MARKS**

(Section I and J)

Q.No	Topic	Marks	BL	CO
1	If the speed reduction ratio is 2, then the diameter of driven pulley will be: a) 0.25 times that of driver pulley **b) 2 times that of driver pulley** c) 0.5 times that of driver pulley d) none	1	3	4
2	The following statement is incorrect a) Equal module gear of any type can be meshed **b) Equal module gear of same type can be meshed** c) Creep in belt drive increases power transmission d) Slip in belt drive increases power transmission	1	2	3
3	The following statement is false: a) For a compound gear train, the intermediate gears does influence the velocity ratio. b) For a simple gear train, the intermediate gears does not influence the velocity ratio. c) The belt drives are referred as friction drives. **d) The gear drives are non-positive drives.** e) None of the above	1	3	3
4	A belt drive has an angle of contact equal to (0.9π) radians on the driven pulley and the total length of the belt wound around the pulleys is found to be 0.9 m. The type of belt used in the drive is: a) Stepped cone **b) Open belt** c) Crossed belt V-belt d) Not possible to decide based on the given data	1	3	4
5	The following statement is true a) Feed check valve helps to prevent the backflow of water from pump to boiler shell. b) Steam stop valve helps to remove entrained water particles in steam. c) Fusible plug helps to monitor steam pressure. d) Economizer helps to prevent the backflow of water to air-preheater. **e) None of the above**	1	2	2
6	Under higher external pressure conditions:	1	3	2

	a) The boiling point of water will be low b) The saturation temperature of water will be equal to atmospheric temperature **c) The saturation temperature of water will be high** d) The superheating of steam is easy to achieve			
7	Boiler-1 and Boiler-2 operates at 70% and 80% efficiency respectively using coal as fuel. The heat gained by water in both the boilers are found to be equal. Further, the rate of steam generation is also the same in both the boilers, then: **a) The fuel consumption of Boiler-2 < fuel consumption of Boiler-1** b) The fuel consumption of Boiler-2 > fuel consumption of Boiler-1 c) The fuel consumption of Boiler-2 = fuel consumption of Boiler-1 d) Cannot determine based on the given data	1	3	1
8	In a normal bicycle having equal sized front and rear wheels, the pedaling sprocket has a diameter twice that of rear wheel sprocket. Then, under ideal running conditions: a) the rear wheel shaft will always rotate slower than the pedaling sprocket b) the rear wheel shaft will always rotate at the same speed of pedaling sprocket **c) the rear wheel shaft and front wheel shaft will always rotate at same speed** d) None of the above	1	3	3
9	A spur gear has 20 teeth and a helical gear has 100 teeth. If both have a module of 2, then the velocity ratio that can be achieved with these two gears will be, • 5 • 0.2 • 100 • **These two gears cannot be meshed**	1	2	4
10	Four gears are used in a compound gear train. The velocity ratio for first pair of meshing gears is 2 while the velocity ratio for the next pair of meshing gears containing the driven gear is 3. Then, a) velocity ratio of gear train will be 2 b) velocity ratio of gear train will be 3 c) velocity ratio of gear train will be 1.5 **d) velocity ratio of gear train will be 6**	1	3	4
11A)	Why are mountings used in boilers? How is the safety of boiler ensured in case of insufficient water in the drum?.	3	3	2
11B)	A steam boiler needs to be operated with highest possible efficiency using the available accessories. The steam generation capacity required is 1000 kg/hr at a pressure of 5.6 bar and 200°C. The boiler is supplied with a feed water at 30°C. The coal consumption is 500 kg/hr and the calorific value of coal is 24 MJ/kg. Use of economizer alone in the boiler will preheat the feed water by 30°C and reduce the coal consumption by 6%. On the contrary, by using an Air-Preheater alone, the coal consumption of boiler can be reduced by 3%. However, if both economizer and air-preheaters are used, then the fuel consumption is found to reduce by 10%. What will be the highest possible efficiency that can be achieved in this boiler?. If due to poor maintenance, there is no steam	4	3	1

	generation from the boiler even after continuous heat release in the furnace, then what will be the boiler efficiency? Assume, C_{pw}= 4.187kJ/kgK and C_{ps}=2.25kJ/kgK. Finding hs=2851.05kj/kg….1mark Finding hw=251.22kj/kg….1mark finding efficiency = 24.07%....1mark finding efficiency = 0 %….1 mark			
11C)	Explain any three advantages of water tube boiler Brief explanation on any three advantages….each point 1 mark	3	2	2
12A)	The available gear options are listed below. Using these gears, determine the maximum possible velocity ratio by using four shafts and minimum possible velocity ratio by using three shafts. Show the arrangement of gear train for both cases. Gear arrangement=1 mark for each VR max= T1/T2 x T4/T3 x T5/T6=5.25…..1 mark VRmin= T3/T4 x T8/T7 =0.1428….1mark	4	3	4
12B)	Three machines are connected to the same motor through a common main shaft using belt drive system. During the operation, Machine-1 requires frequent stoppages while the other two machines are to be operated continuously. The Machine-2 is operated with four different speed variations while Machine-3 is operated with three different speed variations. Draw a neat diagram of this group drive arrangement. Correct arrangement =2 marks. 	2	3	4

Gear	Type	No of teeth	Module (mm)
1	SPUR	90	2
2	SPUR	50	2
3	SPUR	30	3
4	SPUR	70	3
5	HELICAL	100	2
6	HELICAL	80	2
7	HELICAL	60	3
8	HELICAL	20	3

12C)	In a crossed belt drive system, the velocity ratio should be 0.25 for a center distance of 1m. The speed of motor pulley is 1600rpm and diameter of smaller pulley is 0.3m. The permissible tension per meter width of belt is 10kN. If the power transmitted by the belt drive is 28kW, what will be the belt width?. Assume coefficient of friction as 0.3. finding phi=48.59 degrees….0.5 mark theta=4.83 radians…0.5 mark T1/T2=4.27……..0.5marks T1-T2=1114.09……..0.5 mark T1=1454.79N……1 mark T2=340.7N……0.5 mark w=0.14m…….0.5 mark	4	3	4