Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Sixth Semester) Examinations, April 2025

21BMEPC36002/22BMEPC36002 – Machine Design - II

(Mechanical Engineering)

Time: 3 hrs Maximum: 70 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions		CO #	Blooms Level
a.	Explain important properties of bearing material.	CO1	K2
b.	Define creep of belt.	CO2	K1
c.	Explain the function of spring.	CO3	K1
d.	Explain fluctuation of energy in flywheel.	CO4	K1
e.	Explain the various stresses induced in the connecting rod.	CO4	K2

PART – B **(15 x 4 = 60 Marks)**

Answer ***All*** the questions		Marks	CO #	Blooms Level
2. a.	A 150 mm diameter shaft supporting a load of 10 kN has a speed of 1500 rpm. The shaft runs in a bearing whose length is 1.5 times the shaft diameter. If the diametral clearance of the bearing is 0.15 mm and the absolute viscosity of the oil at the operating temperature is 0.011 kg/m-s, find the power wasted in friction.	10	CO1	K4
b.	Explain bearing characteristic number and bearing modulus with the help of a neat sketch.	5	CO1	K3
	(OR)			
c.	Classify various types of rolling contact bearing.	5	CO1	K2
d.	The rolling contact ball bearing are to be selected to support the overhung countershaft. The shaft speed is 720 rpm. The bearings are to have 99% reliability corresponding to a life of 24 000 hours. The bearing is subjected to an equivalent radial load of 1 kN. Consider life adjustment factors for operating condition and material as 0.9 and 0.85 respectively. Find the basic dynamic load rating of the bearing from manufacturer's catalogue, specified at 90% reliability.	10	CO1	K4
3.a.	The inner diameter of a cylindrical tank for liquefied gas is 250 mm. The gas pressure is limited to 15 MPa. The tank is made of plain carbon steel 10C4 (Su = 340 N/mm^2 and μ= 0.27) and the factor of safety is 5. Calculate the cylinder wall thickness.	8	CO2	K3
b.	A hydraulic press has a maximum capacity of 1000 kN. The piston diameter is 250 mm. Calculate the wall thickness if the cylinder is made of material for which the permissible strength may be taken as 80 MPa. This material may be assumed as a brittle material.	7	CO2	K3
	(OR)			
c.	Design a rubber belt to drive a dynamo generating 20 kW at 2250 r.p.m. and fitted with a pulley 200 mm diameter. Assume dynamo efficiency to be 85%. Allowable	15	CO2	K5

	stress for belt = 2.1 MPa, Density of rubber = 1000 kg / m3 ,Angle of contact for dynamo pulley = 165° ,Coefficient of friction between belt and pulley = 0.3			
4.a.	A truck spring has 12 number of leaves, two of which are full length leaves. The spring supports are 1.05 m apart and the central band is 85 mm wide. The central load is to be 5.4 kN with a permissible stress of 280 MPa. Determine the thickness and width of the steel spring leaves. The ratio of the total depth to the width of the spring is 3. Also determine the deflection of the spring.	10	CO3	K3
b.	Differentiate between helical spring and leaf spring.	5	CO3	K2
	(OR)			
c.	A helical cast steel gear with 30° helix angle has to transmit 35 kW at 1500 rpm. If the gear has 24 teeth, determine the necessary module, pitch diameter and face width for 20° full depth teeth. The static stress for cast steel may be taken as 56 MPa. The width of face may be taken as 3 times the normal pitch. What would be the end thrust on the gear? The tooth factor for 20° full depth involute gear may be taken as $(0.154 – 0.912 / T_E)$, where T_E represents the equivalent number of teeth.	10	CO3	K4
d.	Draw a neat sketch of spur gear profile showing all gear terminologies.	5	CO3	K3
5.a.	An Otto cycle engine develops 50 kW at 150 r.p.m. with 75 explosions per minute. The change of speed from the commencement to the end of power stroke must not exceed 0.5% of mean on either side. Design a suitable rim section having width four times the depth so that the hoop stress does not exceed 4 MPa. Assume that the flywheel stores 16/15 times the energy stored by the rim and that the workdone during power stroke is 1.40 times the workdone during the cycle. Density of rim material is 7200 kg / m^3.	15	CO4	K5
	(OR)			
b.	Determine the dimensions of cross-section of the connecting rod for a diesel engine with the following data: Cylinder bore = 100 mm, length of the connecting rod = 350 mm, maximum gas pressure = 4 MPa, factor of safety = 6.	8	CO4	K4
c.	A four-stroke diesel engine has the following specifications: Brake power = 5 kW; Speed = 1200 rpm; Indicated mean effective pressure = 0.35 N/mm^2; Mechanical efficiency = 80 %. Determine: Bore and length of the cylinder, thickness of the cylinder head and size of studs for the cylinder head.	7	CO4	K3

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