DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular/Supplementary Winter Examination – 2024

Course: B.Tech **Branch : Mechanical Engineering/Mechanical Engineering Sandwich**

Semester : V **Subject Code & Name: BTMC503 Theory of Machines - II**

Max Marks: 60 **Date:11/02/2025** **Duration: 3 Hr.**

Instructions to the Students:

1. *Each question carries 12 marks.*
2. *Question No. 1 will be compulsory and include objective-type questions.*
3. *Candidates are required to attempt any four questions from Question No. 2 to Question No. 6.*
4. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
5. *Use of non-programmable scientific calculators is allowed.*
6. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks
Q. 1	**Objective type questions. (Compulsory Question)**		**12**
1	The velocity ratio of two pulleys connected by an open belt or crossed belt is a. directly proportional to their diameters b. inversely proportional to their diameters c. directly proportional to the square of their diameters d. inversely proportional to the square of their diameters	Understand/ CO1	1
2	The velocity of the belt for maximum power is _____ where m = Mass of the belt in kg per metre length. a. $\sqrt{\frac{T}{3m}}$ b. $\sqrt{\frac{T}{4m}}$ c. $\sqrt{\frac{T}{5m}}$ d. $\sqrt{\frac{T}{6m}}$	Analyzing / CO1	1
3	The type of gears used to connect two non-parallel non-intersecting shafts are a. spur gears b. helical gears c. spiral gears d. none of these	Understand/ CO2	1
4	The size of a gear is usually specified by a. pressure angle b. circular pitch c. diametral pitch d. pitch circle diameter	Understand/ CO2	1
5	Which is the incorrect relationship of gears?	Analyzing / CO2	1

	a. Circular pitch × Diametral pitch = π	b. Module = P.C.D/No.of teeth	c. Dedendum = 1.157 module	d. Addendum = 2.157 module		
6	The train value of a gear train is				Understand/ CO2	1
	a. equal to velocity ratio of a gear train	b. reciprocal of velocity ratio of a gear train	c. always greater than unity	d. always less than unity		
7	The maximum fluctuation of energy is the				Understand/ CO3	1
	a. sum of maximum and minimum energies	b. difference between the maximum and minimum energies	c. ratio of the maximum energy and minimum energy	d. ratio of the mean resisting torque to the work done per cycle		
8	The maximum fluctuation of energy in a flywheel is equal to				Analyzing / CO3	1
	a. $I.\omega(\omega_1 - \omega_2)$	b. $I.\omega^2.CS$	c. 2E.CS	d. all of these		
9	A disc is spinning with an angular velocity ω rad/s about the axis of spin. The couple applied to the disc causing precession will be				Analyzing / CO4	1
	a. $\frac{1}{2} I.\omega^2$	b. $I.\omega^2$	c. $\frac{1}{2} I.\omega.\omega_P$	d. $I.\omega.\omega_P$		
10	The rotor of a ship rotates in clockwise direction when viewed from the stern and the ship takes a left turn. The effect of the gyroscopic couple acting on it will be				Understand/ CO4	1
	a. to raise the bow and stern	b. to lower the bow and stern	c. to raise the bow and lower the stern	d. to lower the bow and raise the stern		
11	When there is a reduction in amplitude over every cycle of vibration, then the body is said to have				Understand/ CO5	1
	a. free vibration	b. forced vibration	c. damped vibration	d. all of these		
12	The factor which affects the critical speed of a shaft is				Understand/ CO5	1
	a. diameter of the disc	b. span of the shaft	c. eccentricity	d. all of these		

Q. 2	Solve the following.		12
A)	Obtain an expression for the length of belt in a cross belt drive.	Analyzing / CO1	6
B)	An engine, running at 150 r.p.m., drives a line shaft by means of a belt. The engine pulley is 750 mm diameter and the pulley on the line shaft being 450 mm. A 900 mm diameter pulley on the line shaft drives a 150 mm diameter pulley keyed to a dynamo shaft. Find the speed of the dynamo shaft, when 1. there is no slip, and 2. there is a slip of 2% at each drive.	Evaluating / CO1	6
Q.3	Solve the following.		12
A)	State and prove the law of gearing. Show that involute profile satisfies the conditions for correct gearing.	Analyzing / CO2	6
B)	A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio.	Evaluating / CO2	6
Q. 4	Solve Any Two of the following.		12
A)	What do you understand by 'gear train'? Discuss the various types of gear trains.	Understand/ CO2	6
B)	Explain the terms 'fluctuation of energy' and 'fluctuation of speed' as applied to flywheels.	Analyzing / CO3	6
C)	Two shafts A and B are co-axial. A gear C (50 teeth) is rigidly mounted on shaft A. A compound gear D-E gears with C and an internal gear G. D has 20 teeth and gears with C and E has 35 teeth and gears with an internal gear G. The gear G is fixed and is concentric with the shaft axis. The compound gear D-E is mounted on a pin which projects from an arm keyed to the shaft B. Sketch the arrangement and find the number of teeth on internal gear G assuming that all gears have the same module. If the shaft A rotates at 110 r.p.m., find the speed of shaft B.	Evaluating / CO2	6

Q.5	Solve Any Two of the following.		12
A)	A punching press is driven by a constant torque electric motor. The press is provided with a flywheel that rotates at maximum speed of 225 r.p.m. The radius of gyration of the flywheel is 0.5 m. The press punches 720 holes per hour; each punching operation takes 2 second and requires 15 kN-m of energy. Find the power of the motor and the minimum mass of the flywheel if speed of the same is not to fall below 200 r. p. m.	Evaluating / CO3	6
B)	Describe the gyroscopic effect on an aeroplane.	Understand/ CO4	6
C)	The heavy turbine rotor of a sea vessel rotates at 1500 r.p.m. clockwise looking from the stern, its mass being 750 kg. The vessel pitches with an angular velocity of 1 rad/s. Determine the gyroscopic couple transmitted to the hull when bow is rising, if the radius of gyration for the rotor is 250 mm. Also show in what direction the couple acts on the hull?	Evaluating / CO4	6
Q. 6	Solve Any Two of the following.		12
A)	Discuss briefly with neat sketches the longitudinal, transverse and torsional free vibrations.	Remember / CO5	6
B)	Explain the term 'whirling speed' or 'critical speed' of a shaft. Prove that the whirling speed for a rotating shaft is the same as the frequency of natural transverse vibration.	Analyzing / CO5	6
C)	Explain the terms 'under damping, critical damping' and 'over damping'	Understand/ CO5	6
	*** End ***		