University Institute of Engineering & Technology

(Recognised Under Section 2(f) and 12B of UGC)

Kurukshetra University, Kurukshetra

TIME – 3 Hrs 15 Min

THEORY EXAMINATION – JAN 2021	
B.TECH. – Mechanical	**SEMESTER – V**

M.M. - 56

PAPER - MEC-305

SUBJECT- MECHANICAL VIBRATIONS & TRIBOLOGY

INSTRUCTIONS TO BE FOLLOWED

- **Allotted time for examination is 3 hours 15 minutes that includes time for downloading the question paper, writing answers, scanning of answer sheets and E-mailing the PDF files to the designated Email ID.**
- **For all B Tech. Mechanical Engineering Students, the Email ID is:- btechmechuiet@kuk.ac.in**
- **The candidates will be required to attempt 75% of the question paper (maximum) by choosing to their any best questions accumulating 56 marks.**
- **The PDF files should be saved as Roll No. and Subject Code. Proper attention should be given while sending the email and in the subject line, the Roll Number and Subject Code should be mentioned.**
- **Maximum Page Limit should be 20 (Twenty) for attempting the question paper on A4 sheets which could be downloaded and printed from the sample sheets given in the Kurukshetra University Examination guidelines.**
- **Over-attemptation should be avoided.**
- **Handwriting should be neat and clean and diagrams should be clear and contrasted.**
- **The candidate should not write their Mobile No. otherwise Unfair Means Case will be made.**
- **While attempting the paper, the candidate will use blue/black pen only.**
- **Before attempting the paper, the candidate will ensure that he/she has downloaded the correct question paper. No complaint for attempting wrong question paper by the candidate will be entertained.**
- **Candidate must ensure that he/she has put his/her signature on each page of the answer sheet used by him/her. Answer sheet without the signature of the candidate will not be evaluated.**

PART-A

Q. No. – 1 Answer the following questions. **15x1=15**

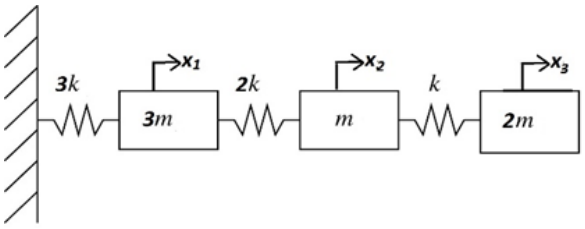
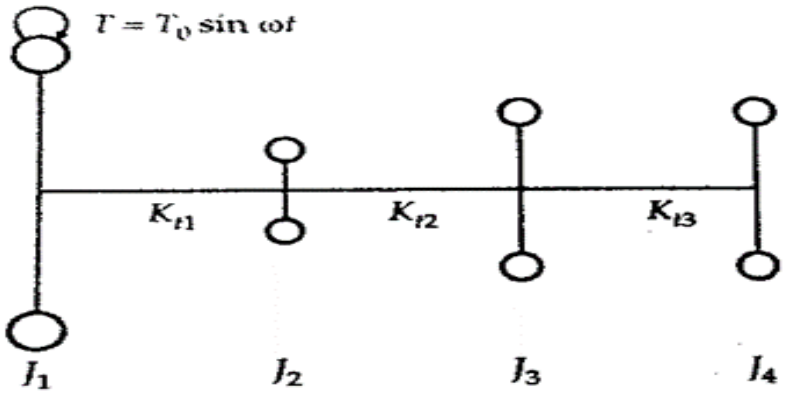
(i)	"Vibrations" are desirable or undesirable, explain in short.
(ii)	Define free and forced vibrations.
(iii)	What do you understand by degree of freedom? Give examples.
(iv)	Define *D'Alemberts* principle.
(v)	Define viscous damping and coulomb damping.
(vi)	Define transmissibility.
(vii)	Write the applications of Rayleigh's method.
(viii)	How do the vibration absorbers work?
(ix)	Define critical speed of shafts.
(x)	What do you understand by transverse vibrations and torsional vibrations?
(xi)	Define the term magnification factor.
(xii)	What are lubricant additives? List three lubricant additives.
(xiii)	Friction is desirable or undesirable, explain in short.
(xiv)	List the techniques used for recycling of used oils.
(xv)	Differentiate between two-body and three-body abrasive wear.

PART-B

2	Find the relation for equivalent stiffness of different spring combinations.	**5**
3	Obtain the steady state response of a linear undamped single degree of freedom system to an alternating square wave excitation.	**5**
4	Derive an equation of motion for the torsional vibrations of the circular uniform shafts.	**5**
5	Explain the friction and wear measurement technique with neat diagram.	**5**

PART-C

6	Show that the mass of a system having overdamping, will never pass through the equilibrium position, if it is given (i) an initial displacement only (ii) an initial velocity only.	**10**
7	The disc of a torsional pendulum has a moment of inertia of 600 kg-cm^2 and is immersed in a viscous fluid. The brass shaft attached to it is of 10 cm diameter and 40 cm long. When the pendulum is vibrating, the observed amplitudes on the same side of the rest position for the successive cycles are 9 degree, 6 degree and 4 degree. Determine (a) Logarithmic decrement (b) Damping torque at unit velocity (c) Periodic time of vibration Assume for the brass shaft, G = 4.4×10^{10} N/m^2 What would the frequency be if the disc is removed from the viscous fluid?	**10**
8	Derive the equations of absolute motion of the body due to support or base excitation.	**10**
9	Derive the characteristic equation of two degree of freedom system with multiple damping elements.	**10**

10	Using matrix iteration method determine the first two natural frequencies and the mode shapes of the system shown in fig. 1.  **fig. 1**	**10**
11	A four−rotor system is represented in fig.2. Find the amplitudes of vibration when the external torque acts on the first rotor. Also find the maximum twist in each section of the shaft. Given: J_1 = 817 kg−m^2, J_2 = 608 kg−m^2, J_3 = 100 kg−m^2, J_4 = 120 kg−m^2, k_{t1}=30 x 10^{6}Nm/rad, k_{t2} = 42 x 10^6 N−m/rad, k_{t3} = 42x10^6 N−m/rad, T_o = 12,000 N−m, ω = 200 rad/sec.  Fig. 2	**10**
12	What is the importance of tribology in design? Explain the characteristics and properties of a lubricant?	**10**
13	What is erosion? What is the effect of angle of attack of impinging particles on rate of erosive wear?	**10**