Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2020

Course: Tribology **Semester: VI**
Program: B. Tech. Automotive Design Engineering **Time As per instructions**
Course Code: MECH3013 **Max. Marks: 100**

Instructions:

1. **Read the question carefully. Some of numerical values are based on your SAP id/roll number.**
2. **Section A** will be conducted online on BB Collaborate platform
3. The maximum time allocated to **Section A** is one Hrs.
4. **Section B** to be submitted within 24 hrs from the scheduled time (*exceptional provision due extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas***)**.
5. No submission of **Section B** shall be entertained after 24 Hrs.
6. **Section B** should be attempted after **Section A**
7. **The section B** should be attempted in blank white sheets (hand written) with all the details like programme, semester, course name, course code, name of the student, Sapid at the top (as in the format) and signature at the bottom (right hand side bottom corner)

SECTION A

S. No.		**Marks**	**CO**
Q 1	Multiple Choice Question. Tick the right answer		**CO1**
1.1	The SI unit of kinematic viscosity is a) m^3/s b) 1/sec c) m^2 d) m^2/sec	**1**	
1.2	The similarity between Bingham fluid and Newtonion fluid is a) both have linear shear stress and strain relationship b) the relationship betweeen shear stress and shear strian is not linear c) the relationship between shear stress and shear strain varies exponentially d) the relationship between shear stress and shear strain varies logrithmically	**1**	
1.3	Which of the following are the limitation of Reynolds' equation? a) inertia force are not considered in Reynolds equation b) the viscosity of the lubricant is considered constant c) variation of the pressure across the film thickness is assumed to be negligible d) all of the above	**1**	
1.4	Coeffient of friction is independent of a) temperature b) surface Roughness c) hardness d) area of contact	**1**	
1.5	Adhension component of dry friction is negligible in which of the following ? a) in high temperature surfaces	**1**	

	b) lubricated tribo pair c) Rough surfaces d) surface with sharp asperities		
1.6	Which of the among is not an adhesive wear mechanism ? a) Galling b) Scoring c) Scuffing d) polishing	**1**	
1.7	As per Archard's wear equation wear volume in adhesive wear is independent of a) Sliding distance of travel b) Load c) hardness of the soft material d) temperature	**1**	
1.8	Erosive wear is a function of a) particle velocity b) impact angle c) size of abrasive d) all of the above	**1**	
1.9	Scratching is a form of a) abressive wear b) adhesive wear c) corrosive wear d) fatigue	**1**	
1.10	Which of the following are the major contributors to rolling friction a) micro slip effect within the contact area b) elastic hysteresis of the contacting materials c) plastic deformation of the material and adhesion effects in the contact d) all of the above	**1**	
1.11	Compared to the shear strength of the tribo surfaces, the shear strength of the lubricant should be a) greater b) lesser c) equal d) can not say	**1**	
1.12	Which of the following represents correct sequence of corrosive wear? 1.sliding surfaces chemically interact with environment. 2. a reaction product (oxide, chloride).3. Wearing away of reaction product film a) 3, 2, 1 b) 2,3,1 c) 1, 3,2 d) 1,2, 3	**1**	
1.13	With increase in bearing clearance the load capacity of the bearing a) Increase b) Decrease c) does not change d) can not say	**1**	

1.14	Which of the following is not a purpose of tribology a) improve service life b) increase safety and reliability c) increase heat generation d) reduce fatigue	**1**	
1.15	Asperities are basically a) sharp tips on the surface b) edge of the surface c) corner of a surface d) hole in a surface	**1**	
1.16	Viscosity index denotes a) relationship between the dynamic and kinematic viscosity b) relationship between viscosity and temperature c) relationship between viscosities of different lubricant d) relationship between viscosity and pressure	**1**	
1.17	Which of the following is a desirable property of boundary lubricant a) dissolvability in lubricating oil b) reactivity with metals in lubricating oils c) low shear strength and high melting point d) all of the above	**1**	
1.18	The major disadvantage with extreme pressure lubricants is a) carcinogenic nature of the lubricant b) low melting point c) it is ineffective d) all of the above	**1**	
1.19	In hydrodynamic lubrication the major source of friction is a) shearing of lubricant film b) viscosity of oil lubricant c) both a and b d) none of the above	**1**	
1.20	Which one is the common system for oil classification? a) SAE(Society of Automobile Engineers) b) API (American Petroleum Institute) c) ISO (International organization for standardization) d) all of the above	**1**	
1.21	Barus relation, shows the relationship between a) lubricant viscosity and temperature b) lubricant viscosity and pressure c) dynamic viscosity and kinematic viscosity d) lubricant temperature and lubricant pressure	**1**	
1.22	Which one of the following statement is true? a) wear rate increases with increasing load b) wear rate decreases with increasing temperature c) wear rate decreases with increasing pressure d) wear rate is independent of load/temperature	**1**	
1.23	Which of the following is not an advantage/benefit of solid lubricant?	**1**	

	a) more effective at high loads b) resistance deterioration c) good heat dissipation d) highly stable in extreme temperature and environment		
1.24	Which of the following is not true about pitting on the gear surface? a) It is surface fatigue failure b) It occurs due to repeated loading of the tooth surface c) It occurs because contact stress exceeds than the surface fatigue strength of the material d) It increases performance of the system	**1**	
1.25	wear rate is lesser in 3 -body abrasion as compared to 2- body abrasion because a) energy is consumed in rolling motion of free hand particles b) only spherical asperities are involved in 3- body abrasion c) size of the asperities is smaller in 3- body abrasion d) none of the above	**1**	
	SECTION-B		
Q2	Kinematic viscosities of oil at 40^0C is **multiplication of the last three digit (non-zero) of your SAP id)** and 100^0C is **multiplication of last two digit (non-zero) of SAP id)** respectively. Find the VI of the oil.	**15**	**CO3, CO4**
Q3	A collar bearing is used to take the thrust of a shaft. The bearing has external diameter 200mm and internal diameter is equal to **external diameter minus the sum of your SAP ID**. An oil film of thickness 0.25mm and of viscosity 0.8 poise is maintained between the collar surface and the bearing. Find the power lost in overcoming the viscous resistance of oil when the shaft is running at 300rpm.	**15**	**CO4**
Q4	A shaft of 100mm diameter rotates at **sum of your SAP id** rpm in a 200 long bearing. Taking that the two surfaces are uniformly separated by a distance of 0. 5 mm and taking linear velocity distribution in the lubricating oil having dynamic viscosity 0.04poise, find the power absorbed in bearing.	**15**	**CO4**
Q5	In a slipper bearing, the slider takes the angle for maximum load and slides over a stationary bearing with a velocity is **last non zero digit of SAP id** m/s. the lubricant filling the interspace between the bearing and the slider has a dynamic viscosity 3.5 poise and density 900kg/m^3. The other pertinent data is h = 0.1mm; l/h_1=500 Estimate a. The position and magnitude of maximum load carrying capacity b. The drag and the power lost in bearing c. A rise in the temperature of oil if Cp= 1000 J/kg-K	**15**	**CO3**
Q6	Explain abrasive wear. Deduce the Rabinowicz's equation of abrasive wear	**15**	**CO2**