Enrollment No: _____ Exam Seat No:_____

C. U. SHAH UNIVERSITY

Summer Examination-2018

Subject Name: Industrial Tribology

Subject Code: 4TE07ITR1 **Branch: B.Tech (Mechanical)**

Semester: 7 **Date: 02/04/2018** **Time: 10:30 To 01:30** **Marks: 70**

Instructions:

(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1 **Attempt the following questions:**

a)	Define average roughness Write its unit.	**01**
b)	Draw the diagram for viscosity vs. pressure and explain in brief.	**01**
c)	Define wear by two different ways	**01**
d)	Give the name of any two solid lubricants	**01**
e)	As per Archard's wear equation, wear volume in adhesive wear is independent of _____.	**01**
f)	Give names of any two viscometers.	**01**
g)	By considering tribological aspects give your comments on smooth and rough surface.	**01**
h)	Write the unit of absolute and kinematic viscosity.	**01**
i)	Write the significant two differences between journal and anti friction bearing.	**01**
j)	Write any two lubricants used in rolling process.	**01**
k)	With neat sketch show surface layers.	**01**
l)	Explain the importance of coating with respect to tribology.	**01**
m)	What is PHD lubrication?	**01**
n)	When the bearing is subjected to large fluctuations of load and heavy impact, the bearing characteristic number should be _____the bearing modulus.	**01**

Attempt any four questions from Q-2 to Q-8

Q-2 **Attempt all questions**

(a)	List different theories of friction. Explain one of them which justifies or explain friction in better manner.	**07**
(b)	Explain Viscosity Index in details.	**07**

Q-3 **Attempt all questions**

(a)	List & explain different types of wear. How would you reduce or eliminate wear from industrial machinery at the design stage?	**07**
(b)	State and explain laws of wear.	**07**

Q-4 **Attempt all questions**

(a)	Give the role of Additives in lubricants. Also explain various types of additives	**07**

generally used according to their functions.

(b) Explain the EHD (elasto hydrodynamic) lubrication in detail. State different examples of it. **07**

Q-5 **Attempt all questions**

(a) State the assumptions made while deriving, **07**

1. Petroff's equation and
2. Reynold's equation

for hydrodynamic journal bearing.

(b) Derive Petroff's equation for hydrodynamic journal bearing. **07**

Q-6 **Attempt all questions**

(a) A full journal bearing is rotating at 1200 rpm, and supporting a load of 6.5 kN. The shaft diameter is 60 mm and bearing diameter is 60.09 mm. l/d ratio is 1. If a minimum film thickness of 0.009 mm is to be maintained, find **07**

1. required viscosity of oil,
2. amount of oil flow rate through the bearing,
3. power lost in friction,
4. temperature rise in oil.

ε	$\frac{h_o}{c_r}$	S	ϕ	$\frac{r}{c_r}f$	$\frac{q}{rc_r n_s L}$	$\frac{q_s}{q}$	$\frac{\gamma . c \Delta t_o}{p}$	$\frac{p}{p_{max}}$
0.6	0.4	0.121	50.58	3.22	4.33	0.680	14.2	0.415
0.8	0.2	0.0446	36.24	1.70	4.62	0.842	8.00	0.313
0.9	0.1	0.0188	26.45	1.05	4.74	0.919	5.16	0.247

(b) Derive the Reynold's equation in two dimensional flows for hydrodynamic lubrication. **07**

Q-7 **Attempt all questions**

(a) Explain following terms with respect to Hydrodynamic journal bearing **07**

1. Long bearing
2. Eccentricity
3. Minimum film thickness
4. Attitude
5. Critical pressure

(b) State and explain the desirable properties of bearing materials. **07**

Q-8 **Attempt all questions**

(a) What is hydrostatic step bearing? Derive equation for load carrying capacity of hydrostatic step bearing. **07**

(b) Give differences between hydrodynamic and hydrostatic journal bearing. **07**