Reg. No.



MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL (A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (AUTOMOBILE ENGINEERING) END SEMESTER EXAMINATIONS, NOV/DEC 2019

SUBJECT: ENGINE TRIBOLOGY [AAE 4019]

REVISED CREDIT SYSTEM (28/11/2019)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitably assumed.

1 A .	List the classical laws of friction and explain the welding, shearing and ploughing theory of friction.	(04)
1B.	With relevant equations, summarize junction growth theory of friction.	(03)
1C.	Explain the stick-slip theory of friction showing the essential graph.	(03)
2A.	Define the phenomenon of wear and explain how the different wear phenomenon are classified, and state the limitations of the classifications.	(04)
2B.	Differentiate between abrasive and adhesive wear.	(03)
2C.	With a neat sketch explain the construction and working of an Efflux viscometer.	(03)
3A.	Explain any 5 important properties of lubricant.	(04)
3B.	Explain the influence of temperature and pressure on the viscosity of a lubricant? Justify using suitable equations.	(03)
3C.	How are the lubricating oils graded according to Viscosity Index? Explain using the relevant graph.	(03)
4A.	List and explain any 5 characteristics of a bearing material?	(04)
4B.	Explain the mechanism of hydrodynamic instability in journal bearings with suitable diagram.	(03)
4C.	A bearing used for light duty compressor has a load of 1 kN and uses an oil of viscosity 205 cP. The journal has a diameter of 50 mm and the bearing diameter is 50.05 mm. The speed of the journal is 15,000 rpm. The L/d ratio is limited to 1.2. Calculate the coefficient of friction and the power loss by Petroff's analysis.	(03)

5A. Derive the equation for friction coefficient for a rolling process showing the **(04)** necessary sketch.

A hydrostatic step bearing has the following specifications. Inlet pressure = 4.5 MPa, viscosity of the lubricant = 0.03 Pa-s, External pressure = 0, Oil Film thickness = 0.005 mm, Vertical load on bearing = 18750 N, Shaft speed =

- **5B.** thickness = 0.005 mm, Vertical load on bearing = 18750 N, Shatt speed = (03) 900 rpm. Assume that the ratio of $r_2/r_1 = 2$. Determine the diameter of the shaft, the rate of oil flow through the bearing and power loss due to viscous friction.
- **5C.** Summarize the causes and remedy for any 3 bearing failures that occur in **(03)** rolling element bearings.