CBCS Scheme

USN | | | | | | | | | | |

16MDE41

Fourth Semester M.Tech. Degree Examination, June/July 2018

Tribology and Bearing Design

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define the following terms:
i) Tribology
ii) Wear
iii) Viscosity
iv) Newton's law of viscosity **(08 Marks)**

b. Derive an expression for discharge through capillary tube with suitable assumptions. **(08 Marks)**

OR

2 a. Explain with neat sketches of any two types of viscometer. **(08 Marks)**

b. A journal bearing has the following specifications:
Shaft diameter = 60 mm
Bearing length = 80 mm
Radial load = 1 kN
Clearance (c) = 0.1 mm
Oil used SAE at 60°C, coefficient of friction 0.042. Determine:
i) Speed of the journal
ii) Power loss **(08 Marks)**

Module-2

3 Derive the expression for Reynolds equation in 2-dimensions and state the assumptions mode. **(16 Marks)**

OR

4 a. Derive an expression for the load carrying capacity of pivoted shoe slider bearing. **(08 Marks)**

b. A rectangular plain slider bearing with fixed shoe with no end leakage has the following data:
Bearing length = 90 mm
Width of shoe = 90 mm
Load on bearing = 7800 N
Slider velocity = 25 cm/sec
Inclination (α) = –0.0035 radians
Viscosity of oil η = 40 cp
Determine: i) Minimum film thickness
ii) Power loss
iii) Coefficient of friction **(08 Marks)**

Module-3

5 a. What is the principle of hydrostatic bearing? Explain hydrodynamic lubrication system with neat sketches. **(08 Marks)**

b. A hydrostatic step bearing has the following data:
Diameter of the shaft = 150 mm
Diameter of the pocket = 100 mm
Vertical thrust on bearing = 60×10^3 N
External pressure = Atmospheric pressure
Shaft speed = 1500 rpm
Viscosity of lubricant = 30 cp, desirable oil film thickness = 0.0125 cm. Determine:
i) Rate of flow
ii) Power loss due to friction
iii) Coefficient of friction **(08 Marks)**

OR

6 a. A circular hydrostatic thrust bearing has the following data:
Shaft dia = 300 mm
Dia of pocket = 200 mm
Shaft speed = 100 rpm
Pressure at the pocket = 500 kN/m^2
Film thickness = 0.07 mm
Viscosity of lubricant = 0.05 Pa.S
Determine:
i) Load carrying capacity
ii) Oil flow rate
iii) Power loss **(08 Marks)**

b. Derive an equation for film thickness of a line contact bearing (Grubin type solution). **(08 Marks)**

Module-4

7 a. List the advantages of antifriction bearing and explain selection and nominal life of antifriction bearing. **(08 Marks)**

b. Explain Fretting phenomenon and its stages of porous bearing. **(08 Marks)**

OR

8 a. Explain the following terms:
i) Bearing mounting
ii) Porous bearing **(08 Marks)**

b. Explain static and dynamic load bearing capacity and also explain gas lubricated bearing. **(08 Marks)**

Module-5

9 a. Explain the following term:
i) Magnetic bearing
ii) Electrical analogy **(08 Marks)**

b. Explain active magnetic bearing with neat labeled diagram. **(08 Marks)**

OR

10 a. Explain magneto-hydrodynamic bearing. **(08 Marks)**

b. What are the advantages and disadvantages of magnetic bearing? **(08 Marks)**

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CBCS Scheme

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16CAE421

Fourth Semester M.Tech. Degree Examination, June/July 2018
Fracture Mechanics

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing one full question from each module.***

Module-1

1 a. Derive an expression for fracture strength of a brittle solid containing a crack using Grifths energy balance. **(08 Marks)**

b. Define fracture. List the use of fracture mechanics in modern engineering design. **(04 Marks)**

c. What is surface energy? Explain. **(04 Marks)**

OR

2 a. Explain 3 basic mode of crack displacement. Explain in detail of mode – I. **(06 Marks)**

b. A plate containing the hole is applied uniform stress σ of a value 100MPa. Estimate the magnitude of stress at a point p as shown in Fig Q2(b) for the condition :

i) a = b ii) $a = \frac{1}{10}b$ iii) a = 10b

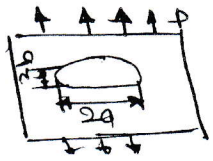

Fig Q2(b) **(06 Marks)**

c. List various method of NDT. Explain any one. **(04 Marks)**

Module-2

3 a. Explain Dugdale's plastic strip model and show that internal stress must be equal the yield strength of material. **(08 Marks)**

b. Explain plastic zone shape for plane stress according to Vonmises criteria. **(08 Marks)**

OR

4 a. A thick center cracked plate of high strength A1 Alloy is 20mm void and contain crack of length 80mm. if it feel IS at applied stress of 100MPa. What is the fracture toughness of alloy? What values of applied stress could the produced fracture for the sample length of crack in a i) Infinite body ii) 120mm wide plate. **(06 Marks)**

b. Explain General test procedure for stress intensities fracture K_{IC}. **(10 Marks)**

Module-3

5 a. Determine the energy release rate for double cantilever beam specimen. **(08 Marks)**

b. Define J. integral. Show that J integral is path dependent. **(08 Marks)**

OR

6 a. Define CTOD and explain. **(05 Marks)**
b. Derive the relation for non-linear energy release rate for Elastic mode – I loading. **(06 Marks)**
c. Explain R-Curve Analysis. **(05 Marks)**

Module-4

7 a. Explain Dynamic fracture toughness and crack arrest toughness. **(05 Marks)**
b. Explain briefly crack branching. **(06 Marks)**
c. Write the principle of crack arrest. **(05 Marks)**

OR

8 a. A 3mm thick crack panel 10cm wide containing edge crack of 1mm yield at a load of 150kN however at a load of 120kN another panel of same material cracked into 2 pieces when crack was 5mm fracture. Calculate yield stress and fracture toughness of material. **(08 Marks)**
b. Explain different type of crack arrest. **(04 Marks)**
c. Write a short note on Dynamic energy release rate. **(04 Marks)**

Module-5

9 a. An edge crack, detected on a large plate is of length 3.1mm under a constant amplitude cyclic load having σ_{max} = 310MPa. And σ_{min} = 172MPa. If plat is made of a ferrite, paralite steel and K_{IC} = 165 MPa $\sqrt{M}$. Determine:
i) Propagation life up to failure
ii) Propagation life the crack length a is not allowed to exceed 25mm
Use $C = 6.8\times10^{-2}$ M = 3, f = 1.12. **(10 Marks)**
b. Explain factor affecting fatigue performance. **(06 Marks)**

OR

10 Write short note on the following (Four)
a. Variabel amplitude loading.
b. Carack Growth behavior
c. Life estimation
d. Crack closure
e. Mixed mode loading **(16 Marks)**

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