KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2024

Marks Scored:

Level : B.E.
Year : III

Course : MEEG 315
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 22 DEC 2024

SECTION "A"
[20 Q. × 1 = 20 marks]

*Use of a Data Book is **NOT** allowed for the objective questions. Choose the most appropriate answer and **mark [X]**.*

1. The notch sensitivity is given by

[ ] $q = \frac{K_f - 1}{K_t - 1}$ [ ] $q = \frac{K_f + 1}{K_t + 1}$ [ ] $q = \frac{K_t - 1}{K_f - 1}$ [ ] $q = \frac{K_t + 1}{K_f + 1}$

2. If a system demands small diameter of shaft and lower noise level which bearing would you choose
[ ] Ball Bearing [ ] Roller Bearing [ ] Journal Bearing [ ] Thrust Bearing

3. Outer diameter of 6201 series bearing is _____ to that of 6101 series bearing.
[ ] Smaller [ ] Larger [ ] Equal [ ] Not applicable

4. Which of the following locking devices achieve locking due to friction?
[ ] Castle nut [ ] Lock nut [ ] locking by pin [ ] locking by plate

5. In hydrostatic bearing, the load capacity
[ ] is independent of speed
[ ] increases with increase in speed
[ ] decreases with increase in speed
[ ] increases exponentially with speed

6. Stress concentration is caused due to
[ ] variation in properties of material from point to point in a member
[ ] pitting at points or areas at which loads on a member are applied
[ ] abrupt change of section
[ ] all of the above

7. Which of the following statement related to Standards and Regulations is not correct?
[ ] Standard is a document approved by a recognized body – there can be multiple standards for one product.
[ ] Regulations are mandatory but Standards are not mandatory.
[ ] Standards after widespread adoption may become de facto regulations.
[ ] The influence of standards and regulations for a project is always known

8. Identify the incorrect statement
[ ] In fillet weld, the weakest area is at called throat
[ ] Decreasing helix angle may lead to self-locking in a power screws
[ ] M05 screw indicates a metric thread with 5 mm major diameter
[ ] Transmission efficiency of square thread is less than acme thread

9. Deep groove ball bearings are used for
[ ] heavy thrust load only
[ ] radial load at high speed
[ ] small angular displacements of shafts
[ ] combined thrust and radial loads at high speed

10. In eccentrically loaded riveted joints, what is the primary effect of the eccentric load on the rivets?
[ ] It causes uniform shear stress in all rivets.
[ ] It induces both direct shear and bending stresses in the rivets.
[ ] It results in only compressive stress on the rivets.
[ ] It leads to a uniform tensile stress across the joint.

11. In Petroff's equation, it is assumed that the lubricant film is
[ ] converging [ ] diverging [ ] uniform [ ] converging diverging

12. Stress concentration factor is defined as
[ ] ratio of highest stress near the discontinuity to endurance limit
[ ] ratio of highest stress near the discontinuity to yield strength
[ ] ratio of endurance limit to highest stress near the discontinuity
[ ] ratio of highest stress near discontinuity to nominal stress

13. Identify the correct statement
[ ] Under fatigue load, casted structures are stronger than welded structures
[ ] Welding cannot produce complicated structures
[ ] Welding can join dissimilar materials
[ ] Rivetted joints produce light weight constructions as compared to welded joints

14. Tearing efficiency of a riveted joint is the ratio of
[ ] Tearing strength of solid plate/tearing strength of punched plate
[ ] Tearing strength of punched plate/tearing strength of the solid plate
[ ] Tearing strength of a rivet/tearing strength of sold plate
[ ] None

15. In a radial rolling element bearing, on increasing the size of the rolling elements would
[ ] Decrease load bearing capacity
[ ] Increase load capacity of the radial bearing
[ ] Increase or decrease depending on the constraint on outer diameter of outer ring
[ ] Increase or decrease depending on the constraint on bore diameter of inner ring

16. The designation M 36 x 2 means
[ ] metric threads of 36 mm core diameter and 2 mm pitch
[ ] metric threads of 36 mm pitch diameter and 2 mm pitch
[ ] metric fine threads of 36 mm outside diameter and 2 mm pitch
[ ] metric coarse threads of 36 mm outside diameter and 2 mm pitch

17. Split nut is a locking device in which
[ ] an elastic piece is tightened in the nut by a setscrew
[ ] a smaller nut is tightened against main nut creating friction of the contact surface
[ ] a slot is cut in the middle of nut along the length and a cap screw is provided to tighten the two parts of nut separated by slot
[ ] a split pin is passed through diametrically opposite slots in nut and a hole in bolt and the two ends of split pin are separated and bent back on nut

18. The weakest plane in a fillet weld is

[ ] the throat
[ ] smaller of two sides
[ ] side parallel to the force
[ ] side normal to the force

19. The purpose of circumferential lap joint in boiler shell is

[ ] to make cylindrical ring from steel plate
[ ] to increase the length of boiler shell by connecting one ring to another
[ ] to make diameter and length of boiler shell
[ ] to connect openings to shell

20. In a radial rolling element bearing, on increasing the size of the rolling elements would

[ ] Decrease load bearing capacity
[ ] Increase load capacity of the radial bearing
[ ] Increase or decrease depending on the constraint on outer diameter of outer ring
[ ] Increase or decrease depending on the constraint on bore diameter of inner ring

KATHMANDU UNIVERSITY
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Level : B.E.
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Time : 2 hrs. 30mins.

22 DEC 2024

Course : MEEG 315
Semester : I
F. M. : 55

SECTION "B"
[5 Q. × 11 = 55 marks]

*Attempt ALL questions. Use of Data Book is **ALLOWED** for this examination. Assume and/or select suitable data if not specified.*

1.

a. Determine the forces acting on all the rivets and the size of the rivet for the structural joint shown below if the permissible shear strength is 85 MN/m^2. [5]

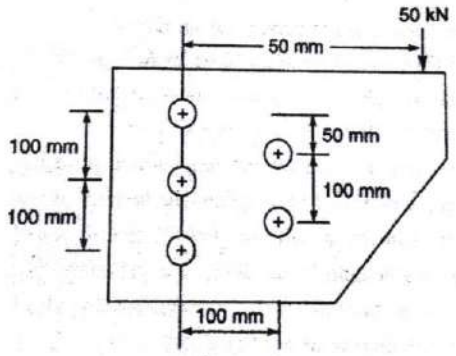

Figure 1

b. Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm2. Assume joint efficiency as 75%, allowable tensile stress in the plate 90 MPa; compressive stress 140 MPa; and shear stress in the rivet 56 MPa. [6]

2.

a. Identify the parts show in the figure below and explain their applications. [3]

b. What information is needed for a designer before starting a design? List several factors that might be used to judge how well a proposed design meets its specified objectives. [4]

c. Explain how brainstorming and mind mapping help in the decision-making process. Take an example and elaborate in relation to the example. [4]

P.T.O.

3.

a. Two bearings are labeled with the number 6205 and 6305. Explain when to use 6205 or 6305. What are the differences and similarities between these two bearings? [3]

b. A plate 100 mm wide and 12.5 mm thick is to be welded to another plate using single transverse and double parallel fillet welds as shown in Figure 2. Determine the length of the weld run in each case if the joint is subjected to varying loads. The recommended design stress in tension is not to exceed 70 N.mm^2 and in shear 56 N/mm^2 for static loading. [5]

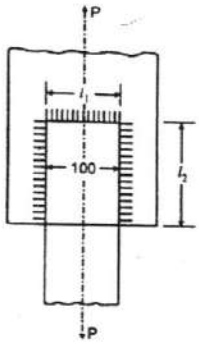

Figure 2

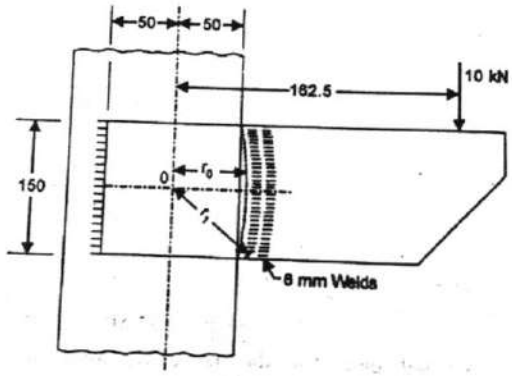

Figure 3

c. Determine the maximum stress in the reinforced weld of the bracket plate shown in the figure 3. Assume that the load varies from zero to the maximum value. [3]

4.

a. A company replaced Helical Spring 1 in a system with Helical Spring 2 with the dimensions given below:

i. Spring 1
D1 = 50 mm, d1 = 5 mm

ii. Spring 2
D2 = 20 mm, d2 = 4 mm

Explain the effect of this change on the Wahl Stress Factor. [2]

b. A shaft rotating at 1500 rpm is supported by two bearings. The forces acting on each bearing are 6000 N radial load and 3500 N axial thrust. If the shaft diameter is 50 mm and the expected life of the bearing is 1000 h, select suitable single row deep groove ball bearing. [5]

c. Determine the dimensions of a bearing and journal to support load of 5500 N at 800 rev/min using hardened steel journal and bronze-backed bearing. An abundance of oil is provided which has a specific gravity of 0.9 at 15.5°C and a viscosity of 10.2 centistokes at 82°C that may be taken to the limiting temperature for oil. Assume a clearance of 0.0025 cm per cm of diameter. Calculate also the rate of heat generated in the bearing. [4]

5.

a. A differential screw jack has the following specifications:

Screw A	p_1=8 mm	d_1= 46 mm	Right Hand
Screw B	p_2=6 mm	d_2= 29 mm	Right Hand

The coefficient of friction between the threads is 0.15. Find the torque required at A to raise a load of 4 kN. Also, find the efficiency of the arrangement. [5]

b. Design a valve spring for an automobile engine, when the valve is closed, the spring produces a force of 45 N and when it opens, produces a force of 55 N. The spring must fit over the valve bush which has an outside diameter of 20 mm and must go inside a space of 35 mm. The lift of the valve is 6 mm. The spring index is 12. The spring is made of chrome vanadium steel and factor of safety is equal to 2. [6]

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Level : B.E.
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Course : CHEG 322
Semester : I

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Time: 30 mins.

F. M. : 10

Registration No.:

Date : 20 DEC 2024

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose and encircle in the most appropriate option from each set of choices

1. What is limiting nutrient for eutrophication in the freshwater?
   a. Nitrogen b. Phosphorus c. Sulphur d. Calcium

2. Why is peak heating phase in composting important?
   a. Recover heat for other use
   b. Kill pathogens and weed seeds
   c. Improve bacterial activities
   d. Keep birds away from the pile

3. What happens in preliminary wastewater treatment?
   a. Grit removal
   b. Sedimentation
   c. Equalization of flow
   d. BOD removal

4. The correct relation between theoretical oxygen demand (TOD), Biochemical oxygen demand (BOD), and Chemical oxygen demand (COD) is given by:
   a. TOD > BOD > COD
   b. TOD > COD > BOD
   c. BOD > COD > TOD
   d. COD > BOD > TOD

5. What is the chemical formula of cell mass?
   a. C5H7O2N b. C7H5O2N c. C5H7N2O d. C7H5N2O

6. Composting and lagooning are the methods of:
   a. Sludge retention b. Sludge disposal c. Sedimentation d. Filtration

7. Blue baby disease found in infants is due to excessive _____ in drinking water.
   a. Color b. Sulphates c. Carbonates d. Nitrates

8. Activated sludge process is an example of?
   a. Anaerobic suspended growth process
   b. Anaerobic attached growth process
   c. Aerobic attached growth process
   d. Aerobic suspended growth process

9. What does Tanner's triangle assess?
   a. Compactness of waste
   b. Permeability of waste
   c. Voidness of waste
   d. Combustibility of waste

10. What is the best way to maintain CN ratio in composting?
    a. Co-composting
    b. Dilution
    c. Increase water content
    d. Increasing temperature

11. Facultative bacteria are able to work in?
    a. Presence of oxygen only
    b. Absence of oxygen only
    c. Presence as well as in absence of oxygen
    d. Presence of water

12. What does RDF mean?
    a. Residual derived fuel
    b. Refuse derived fuel
    c. Reuse derived fuel
    d. Recycle derived fuel

13. What is limiting nutrient for eutrophication in the sea?
    a. Nitrogen
    b. Phosphorus
    c. Sulphur
    d. Calcium

14. What are key variables in characterizing as fuel?
    a. Moisture, inorganic, organic
    b. Moisture, ignitability, organic
    c. Moisture, ignitability, inorganic
    d. Ignitability, organic, inorganic

15. What is ThCOD of C3H6O2 in g O2/g C3H6O2?
    a. 0.5
    b. 1.5
    c. 2.5
    d. 3

16. If the sewage contains grease and fatty oils, these are removed in?
    a. Grit chamber
    b. Detritus tanks
    c. Skimming tanks
    d. Sedimentation tanks

17. Activated carbon is used for?
    a. Disinfection
    b. Removing hardness
    c. Removing odors
    d. Removing corrosiveness

18. What is the recommended moisture content of finished compost?
    a. 15%
    b. 30%
    c. 50%
    d. 70%

19. The dissolved oxygen level in natural unpolluted waters at normal temperature is found to be of the order of (in mg/L):
    a. 1
    b. 10
    c. 100
    d. 1000

20. Nitrification is performed by:
    a. Anaerobic autotrophic chemolithotrophs
    b. Aerobic autotrophic chemolithotrophs
    c. Anaerobic heterotroph chemolithotrophs
    d. Aerobic heterotroph chemolithotrophs