

**GET 251 2017/2018**



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**2017/2018 HARMATTAN SEMESTER EXAMINATIONS**

**GET 251: ENGINEERING MECHANICS I      2 UNITS**

**THURSDAY, DECEMBER 7, 2017**

**EXAMINATION TIME: 8:30 A.M. – 11:30 A.M.**

**TIME ALLOWED: 2½ HOURS**

**INSTRUCTIONS: Answer all (35) questions**

*(YOU ARE REQUIRED TO FILL IN YOUR PARTICULARS HERE AND ON THE ANSWER BOOKLET)*

**MATRICULATION NUMBER:** .....

**COLLEGE:** .....

**DEPARTMENT:** .....

**DEGREE PROGRAMME:** .....

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**PLEASE TURN OVER ONLY WHEN INSTRUCTED TO START BY THE INVIGILATOR**



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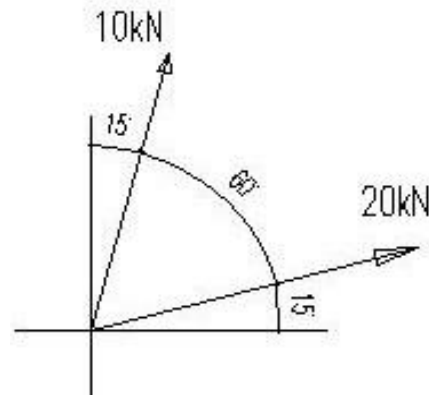
1. The fundamentals of engineering mechanics is based on....
- Isaac Newton's laws of Motion
  - Isaac Newton's laws of Gravity
  - Euler's laws of Motion
  - Lagrangian's laws of Motion

2. STATICS can be defined as ...
- Study of internal force system in a body.
  - Study of effect of force(s) on a body in a state of continuous motion.
  - Study of the effect of force(s) on the equilibrium of body at rest or at a constant velocity.
  - Study of the effect of forces on bodies that are in motion.

3. Dynamics can further be subdivided into two parts, namely:
- Kinetics & Kinodynamics
  - Kinematics & Kinetics
  - Kinetics & Potential
  - Kinematics & Potential
4. When two or more forces have their lines of action intersected at a point, the force system is best described as...
- Concurrent.
  - Coplanar.
  - Collinear.
  - Non-Coplanar.

5. When two or more forces have their lines of action on the same plane, the force system is called...
- Concurrent

- Coplanar
- Collinear
- Non-Coplanar



Use Figure 1 above to answer questions 6 & 7

6. Determine the resultant force to the nearest whole number for Figure 1 shown above
- 29 kN
  - 27 kN
  - 25 kN
  - 23 kN
7. The direction of the resultant force from x-axis
- 34°
  - 32°
  - 30°
  - 28°
8. The following are true for a body under static equilibrium
- Sum of all the forces must equal zero





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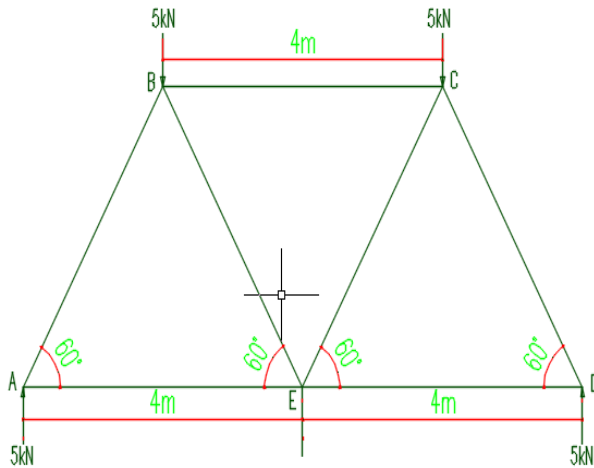
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- (ii) Moments must be either clockwise or counter-clockwise
- (iii) Forces must have their lines of action parallel to each other.
- (iv) Sum of all the moments must equal zero.
- a. i, ii, iii  
b. ii, iii, iv  
c. i, iii, iv  
d. None of the above.
9. .... is a drawing that shows a particle with all the forces that act on it and making it look like it is “free from its surrounding”.
- a. Shearing Force Diagram (SFD).  
b. Bending Moment Diagram (BMD).  
c. Free-Body Diagram (FBD).  
d. Force-Body Diagram (FBD).
10. The moment of the force about point O for Figure 2 shown below is ...
- 
- a.  $M_o = 200 \text{ Nm}$  clockwise  
b.  $M_o = 200 \text{ Nm}$  clockwise  
c.  $M_o = 200 \text{ Nm}$  clockwise  
d.  $M_o = 200 \text{ Nm}$  clockwise
11. The support that provides a restraint against translational movements in both x-axis and y-axis directions is called ...
- a. Fixed  
b. Hinged  
c. Spring  
d. Roller
12. The support that provides restraint against rotational and translational movements in both x and y axes is called...
- a. Fixed  
b. Hinged  
c. Spring  
d. Roller
13. All of these are the assumptions made while computing the forces in the members of a perfect frame/truss, except;
- a. The frame is loaded only at the joints.  
b. The frame/truss is a perfect frame.  
c. All members are fixed jointed.  
d. The self-weight of the members is neglected
14. The force that tends to elongate a member and caused reduction in cross-sectional area is ...
- a. Compressive  
b. Torsional  
c. Twisting  
d. Tensile



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Use Figure 3 below to answer questions 15 – 18



15. The truss above is...

- a. Symmetrical
- b. Planar
- c. Congruent
- d. Systemic

16. The force in member AB is

- a. 5.7735 kN (C)
- b. 5.7735 kN (T)
- c. 2.8868 kN (T)
- d. 2.8868 kN (C)

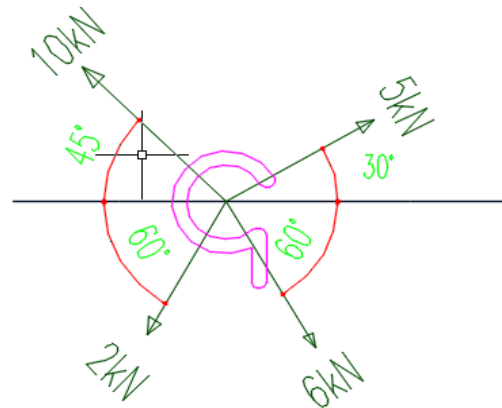
17. The force in member AE is

- a. 5.7735 kN (C)
- b. 5.7735 kN (T)
- c. 2.8868 kN (T)
- d. 2.8868 kN (C)

18. The force in member DE is

- a. 2.8868 kN (T)
- b. 2.8868 kN (C)
- c. 5.7735 kN (T)
- d. 5.7735 kN (C)

As shown in Figure 4 below, four concurrent forces were applied to the screw eye. Use the figure 4 to answer questions 19 & 20



19. Resolve the concurrent forces along x-axis.  $\sum F_x =$

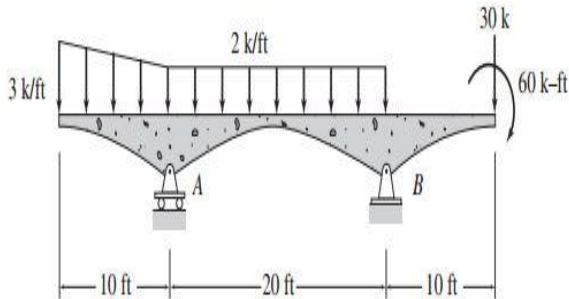
- a. 2.643 kN
- b. -2.643 kN
- c. 0.741 kN
- d. -0.741 kN

20. The resultant force for the above force system is ...

- a. -0.741 kN
- b. -2.643 kN
- c. 2.745 kN
- d. -2.745 kN

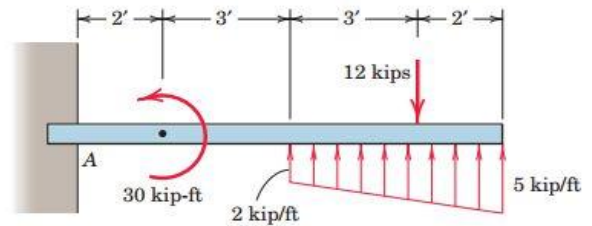
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Use Figure 5 below to answer questions 21 to 23



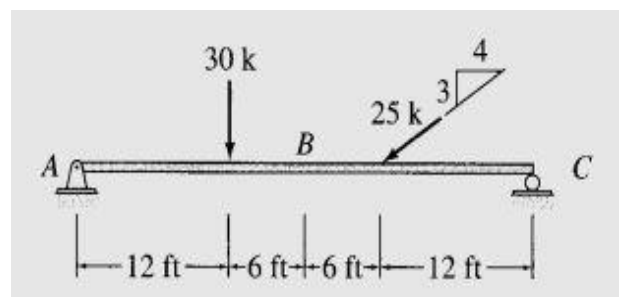
21. The sum of the vertical ACTION forces acting on the bridge is ...
  - a. 80 k
  - b. 85 k
  - c. 90 k
  - d. 95 k
22. The actual value of the vertical reaction at support B is ...
  - a. 57.33 k
  - b. 61.33 k
  - c. 64.33 k
  - d. 67.33 k
23. The actual value of the vertical reaction at support A is ...
  - a. 30.67 k
  - b. 33.67 k
  - c. 36.67 k
  - d. 40.67 k

Use Figure 6 below to answer questions 24 and 25. The unit of length is in feet ( ' ).



24. The value of the reaction moment at the fixed support A is ...
  - a. 68.5 kip.ft
  - b. 71.5 kip.ft
  - c. 76.5 kip.ft
  - d. 80.5 kip.ft
25. The value of the vertical reaction at the fixed support A is ...
  - a. 2.5 kips
  - b. 5.5 kips
  - c. 7.5 kips
  - d. 9.5 kips

Use Figure 7 below to answer questions 26 to 28





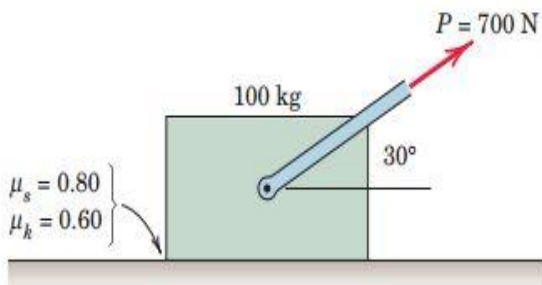
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26. The value of the axial force at point B is ...
- 15 k
  - 18 k
  - 20 k
  - 24 k

27. The value of the shear force at point B is ...
- 2 k
  - 5 k
  - 8 k
  - 10 k

28. The value of the bending moment at point B is ...
- 170 k.ft
  - 200 k.ft
  - 235 k.ft
  - 270 k.ft

Use Figure 8 below to answer questions 29 and 30



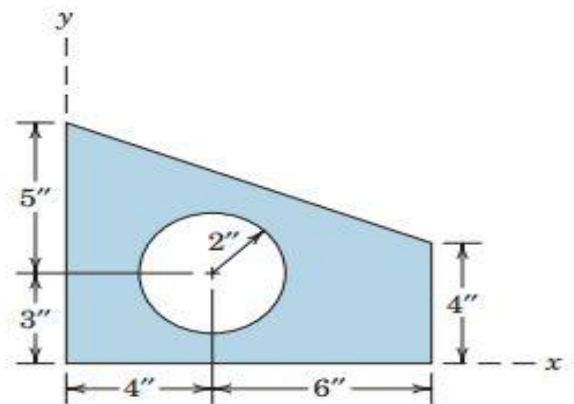
29. The value of the normal force N acting on the contacting surface between the 100 kg block and the ground is ...

- 250 N
- 480 N
- 600 N
- 631 N

30. The value of the frictional force F, if there is motion (where  $F > F_{\max}$ ) is ...

- 300 N
- 330 N
- 359 N
- 379 N

Use Figure 9 below to answer questions 31 to 33. All units are in inches (").





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31. What is the area of the shaded portion (excluding the circle) of the figure?

- a.  $47.43 \text{ in}^2$
- b.  $53.43 \text{ in}^2$
- c.  $58 \text{ in}^2$
- d.  $62 \text{ in}^2$

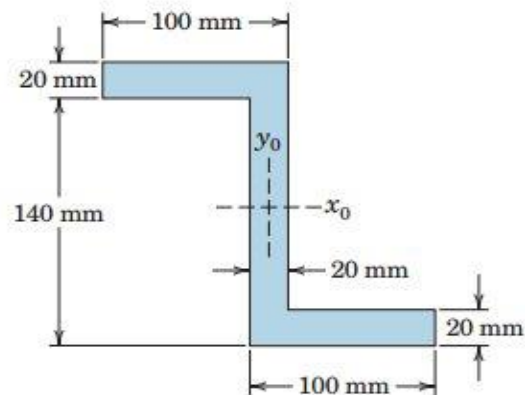
32. What is the distance between the centroid of the shaded area and the  $y$  axis?

- a. 3.88 in
- b. 4.12 in
- c. 4.56 in
- d. 5.66 in

33. What is the distance between the centroid of the shaded area and the  $x$  axis?

- a. 2.54 in
- b. 3.14 in
- c. 3.56 in
- d. 4.44 in

Use Figure 10 below to answer questions 34 and 35. All units are in mm.



34. The value of the second moment of area of the  $z$  section about the centroidal  $x_0$  axis is ...

- a.  $18.52 \times 10^6 \text{ mm}^4$
- b.  $20.61 \times 10^6 \text{ mm}^4$
- c.  $22.61 \times 10^6 \text{ mm}^4$
- d.  $25.13 \times 10^6 \text{ mm}^4$

35. The value of the second moment of area of the  $z$  section about the centroidal  $y_0$  axis is ...

- a.  $5.20 \times 10^6 \text{ mm}^4$
- b.  $7.53 \times 10^6 \text{ mm}^4$
- c.  $9.81 \times 10^6 \text{ mm}^4$
- d.  $11.13 \times 10^6 \text{ mm}^4$

