

UNIVERSITY OF BARISAL
 Department of Computer Science and Engineering
 1st Year 2nd Semester Final Examination, 2022
 Session: 2021-2022

Course code: **EEE-1207**, Course name: **Basic Mechanical Engineering**

Time: 3 hrs.

Marks: 60

1(a). A 90-lb load is suspended from the hook shown in Figure If the load is supported by two cables and a spring having a stiffness $k = 500 \text{ lb/ft}$, determine the force in the cables and the stretch of the spring for equilibrium. Cable AD lies in the x - y plane and cable AC lies in the x - z plane. **06**

1(b). Determine the stretch in each of the two springs required to hold the 25-kg crate in the equilibrium position shown. Each spring has an unstretched length of 2.1 m and a stiffness of $k = 300 \text{ N/m}$. **06**

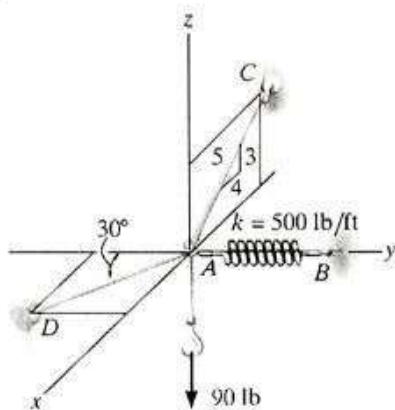


Figure for Q. No. 1(a).

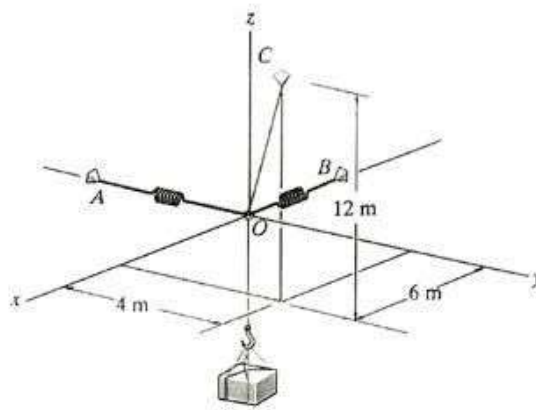


Figure for Q. No. 1(b).

2(a). A 4.80m long beam is subjected to the forces shown. Reduce the given system of forces to (a) an equivalent force-couple system at A, (b) an equivalent force-couple system at B, (c) a single force or resultant. **6**

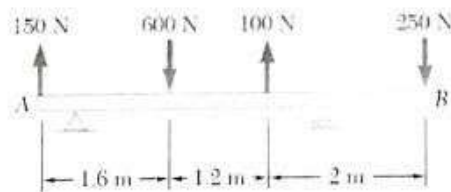


Figure for question no 2(a)

2(b). Arm AB has a constant angular velocity of 15 rad/s counter clockwise. At the instant when $\theta = 90^\circ$, determine the acceleration (a) of collar D, (b) of the midpoint G of bar BD. **6**

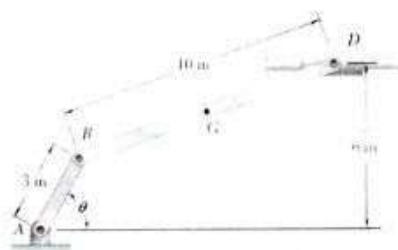


Figure for question no 2(b)

3(a). Determine the components of the forces acting on each member of the frame shown. **06**

3(b). In the engine system shown, the crank AB has a constant clockwise angular velocity of 2000 rpm. For the crank position shown, determine (a) the angular velocity of the connecting rod BD , (b) the velocity of the piston P . **06**

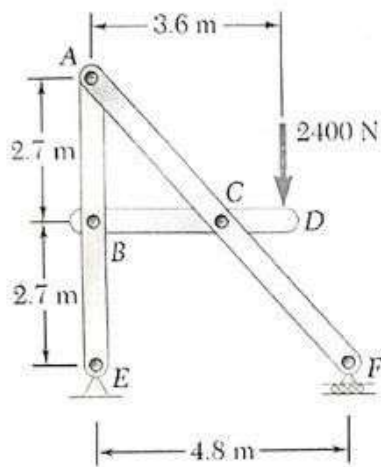


Figure for Q. No. 3(a).

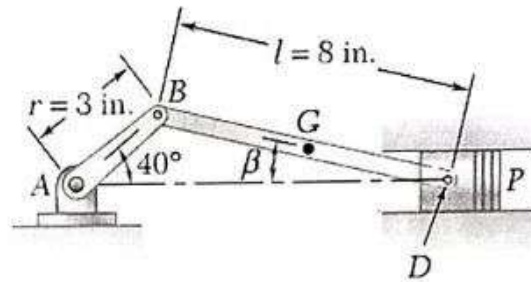


Figure for Q. No. 3(b).

- 4(a). What is "Robot"? Classify robot and mention its application. **4**
 4(b). What are the basic components of a Robotic system? Write short note on:
 (i) Manipulator, and (ii) End effector. **5**
 4(c). Write down the differences between field robots and service robots. Also explain robot control methods. **3**

5(a). What is meant by Robot sensor? Explain the mechanism of following sensors with their applications: **06**

- (i) Potentiometer sensor, (ii) LVDT sensor, and (iii) Piezoelectric sensor.

5(b). What is meant by Robot actuator? What are the different types of actuator used for Robot? **03**

5(c). What is forward kinematics and inverse kinematics? Explain. **03**

6(a). Write down the differences between internal combustion engine and steam engine. Also classify I.C engines. **3**

6(b). Describe the working principle of a four-stroke cycle diesel engine with appropriate sketches. **4**

6(c). Write short note on:
 i) Cylinder head, ii) Piston, iii) Crankshaft, iv) Flywheel and v) Crank case. **5**

7(a). What is meant by refrigeration? Explain the purpose and application of refrigeration. **03**

7(b). Explain the vapor compression refrigeration system with the help of P-h and T-s diagram. **03**

7(c). Describe the classification of air-conditioning system. **02**

7(d). Explain the working principle of a winter air-conditioning system with a suitable sketch. **04**

8(a). What is meant by renewable energy? Distinguish between conventional energy and non-conventional energy. **04**

8(b). What are the properties of a good refrigerant? **03**

8(c). What is human comfort? What are the factors that affecting the human comfort. **03**

8(d). How can you classify refrigerants? What is the unit of refrigeration? **02**

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