Principles Of Engineering

Final Examination

Part A

Fall 2006-07

Student Name: _____

Date: _____

Class Period: _____

Total Points: _____/40

Converted Score: _____/50

Directions: **Circle the letter of the response that best answers the question or completes the statement. Then fill in the separate *Part A Answer Sheet.***

Reference Tables are available on Pages 9 & 10.

1. Orville and Wilbur Wright's first successful flight of a heavier-than-air powered aircraft took place during which century?

   A. 18^{th} century
   C. 20^{th} century
   B. 19^{th} century
   D. 21^{st} century

2. An engineering technician would generally be more involved in _____ than would an engineer.

   A. researching a product idea
   C. servicing and maintaining equipment
   B. the initial design of a product
   D. conducting complex analysis

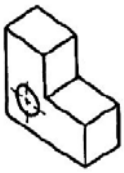


Figure 1a

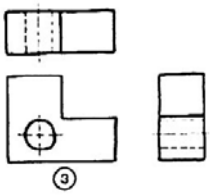


Figure 1b

3. Figure **1a** represents a(n) _____ drawing and Figure **1b** represents a(n) _____ drawing.

   A. isometric, orthographic
   C. cabinet oblique, orthographic
   B. orthographic, isometric
   D. isometric, cavalier oblique

4. _____ would be an effective means of documenting the development of a manufacturing process. It would include sections such as a title page, table of contents and appendices.

   A. An abstract
   C. A technical report
   B. A resume
   D. A design brief

5. The image shown in Figure 2 represents a _____.

   A. line graph.
   C. bar chart.
   B. spreadsheet.
   D. pie chart.

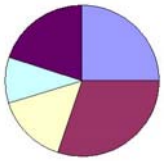


Figure 2

6. An effective presentation _____.

A. would not include visual aids.
B. contains a few graphics and large amounts of text.
C. has text that will be read word for word by the presenter.
D. lists major points rather than lengthy details.

7. In the design process, a constraint would be defined as _____.

A. a restriction or guideline.
B. a procedure or plan.
C. the introduction of a new idea.
D. an old idea being reintroduced.

8. Study the gear train in Figure 3. What is the purpose of the center gear?

A. To increase the rotational output
B. To maintain the direction of rotation from the input to the output gear
C. To decrease the rotational output
D. To change the direction of rotation from the input to the output gear

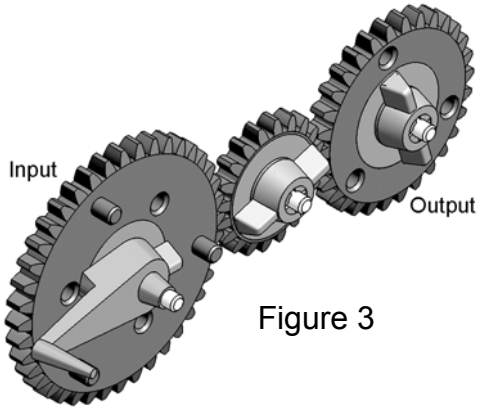
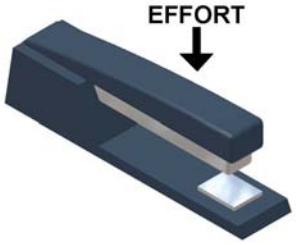


Figure 3

9. The stapler in Figure 4 is an example of what class of lever?

A. 1st class
B. 2nd class
C. 3rd class
D. 4th class



10. A CD is used as a wheel on a mouse trap powered vehicle, and has a diameter of 7.45". If the mouse trap powered vehicle must travel exactly 144'', how many revolutions would the wheel make? Assume that no sliding or slipping occurs between the wheel and the track surface.

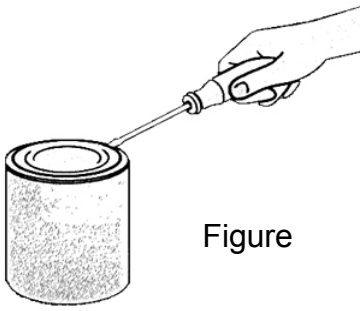
A. 615
B. 6.15
C. .615
D. 12.3

11. If a simple machine requires more effort force than resistance force, the mechanical advantage would be a value that is _____.

A. one.
B. greater than one.
C. less than one.
D. zero.

12. A screwdriver functions as a(n) _____ when used to pry open a can of paint, as illustrated in Figure 5.

A. wedge
B. lever
C. screw
D. inclined plane



Figure

13. What is the resistive force of the pulley system in Figure 6 if it is in static equilibrium, has a mechanical advantage of 5, and requires 20 lbs. of effort force?

A. 4 lbs.
B. 100 lbs.
C. 400 lbs.
D. 80 lbs.

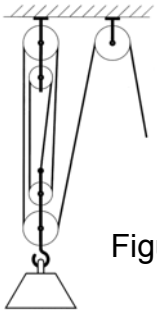


Figure 6

14. The sun heating the earth is an example of which type of energy transfer?

A. Convection
B. Conduction
C. Radiation
D. R-value

15. What type of fluid is most commonly used in industrial hydraulic systems?

A. Water
B. Gas
C. Tree sap
D. Oil

16. According to Pascal's Law, a force that is exerted on a fluid will be transferred _____ against the walls of that fluid's container.

A. equally
B. inversely
C. partially
D. fluidly

17. If one light bulb burns out in a string of lights, and the rest stay lit, it is reasonable to assume that the lights are wired in _____.

A. series.
B. line.
C. order.
D. parallel.

18. If the motor in Figure 7 draws 0.15 Amps and provides 80 Ohms of resistance, how many Volts should the multimeter read?

A. 0.12 VDC
B. 12 VDC
C. 120 VDC
D. 1200 VDC

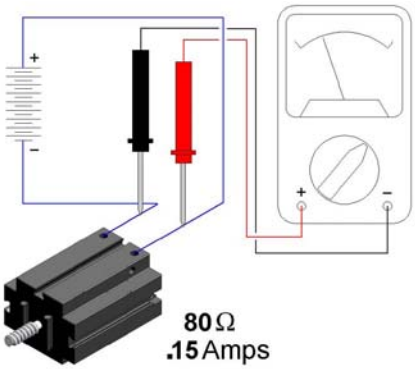


Figure 7

19. Which of the following is used to take information from input devices, process it according to a program, and control output devices?

A. microswitch
C. microprocessor
B. micromachine
D. microwave

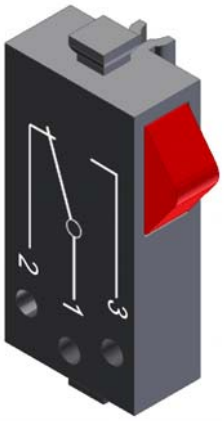


Figure 8

20. If electrical wires are connected to ports 1 and 3 on the limit switch in Figure 8, then the switch will be wired normally-_____.

A. common.
C. closed.
B. open.
D. neutral.

21. A characteristic of a closed-loop system that differentiates it from an open-loop system is that a closed-loop system has _____.

A. input.
C. feedback.
B. process.
D. output.

22. Which of the following input device is controlled by a magnetic field?

A. Reed Switch
C. Electromagnet
B. Photoresistor
D. Lamp

23. What is the condition required for the truss system in Figure 9 to be in static equilibrium?

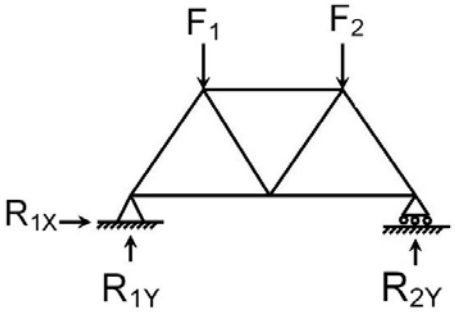


Figure 9

A. $F_1 + F_2 Sin\theta = R_{1Y} + R_{2Y}$
C. $F_1 + F_2 = R_{1Y} + R_{2Y}$
B. $F_2 Cos\theta = R_{2Y}$
D. $F_1 = R_{1Y}$

24. What force should the rope be able to withstand at **Point C** in order for the beam in Figure 10 to be in static equilibrium?

A. 5 lbs.
C. 10 lbs.
B. 20 lbs.
D. 15 lbs.

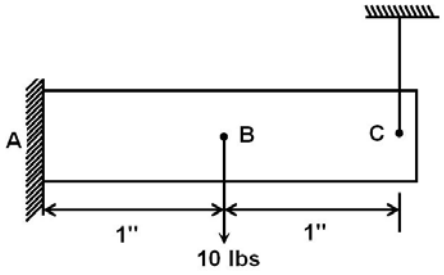


Figure 10

25. Which of the following is a scalar quantity?

A. Force
C. Acceleration
B. Mass
D. Velocity

26. Based on the truss shown in Figure 11, what is the value R_{AY}?

A. 20 lbs.
C. 10 lbs.
B. 15 lbs.
D. 5 lbs.

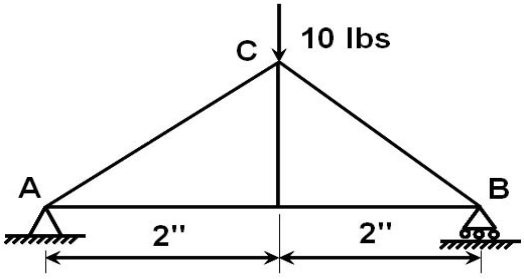


Figure 11

27. If an engineer knows the moment of inertia (also referred to as second moment of area) of a structural beam's cross-section, then he or she can use that information to calculate the _____.

A. deflection in the beam.
C. mass of the beam.
B. standard deviation of the beam.
D. centroid of the beam.

28. What do points A, B and C represent in Figure 12?

A. Centroids
C. Mid Points
B. Medians
D. Yield Points

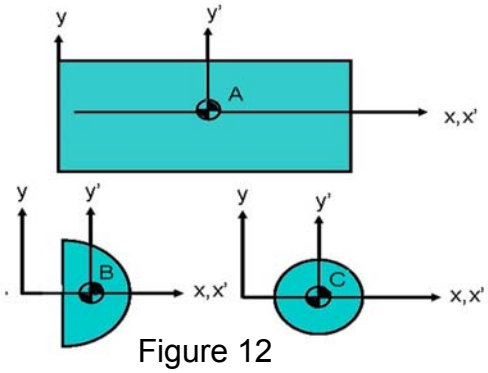


Figure 12

29. All materials are composed of _____ that are joined together to form molecules.

A. alloys
C. compounds
B. elastomers
D. atoms

30. _____ of materials include: chemical, physical, mechanical, electrical, thermal, and dimensional.

A. Resistance
C. Toughness
B. Phases
D. Properties

31. Which of the following manufacturing tools is used to create parts from heated plastic?

A. Drill Press
C. Lathe
B. Injection Molder
D. Milling Machine

32. Which of the following manufacturing processes is used to machine a long piece of metal into a cylindrical form?

A. Turning
C. Annealing
B. Forging
D. Threading

33. _____ is used to ensure that a manufactured product conforms to standards at various points during its manufacture.

A. Variance
C. Standard deviation
B. Quality control
D. Normal distribution

34. The dial caliper in Figure 13 is set to a measurement of _____ inches.

A. 0.010
C. 0.001
B. 1.010
D. 0.101

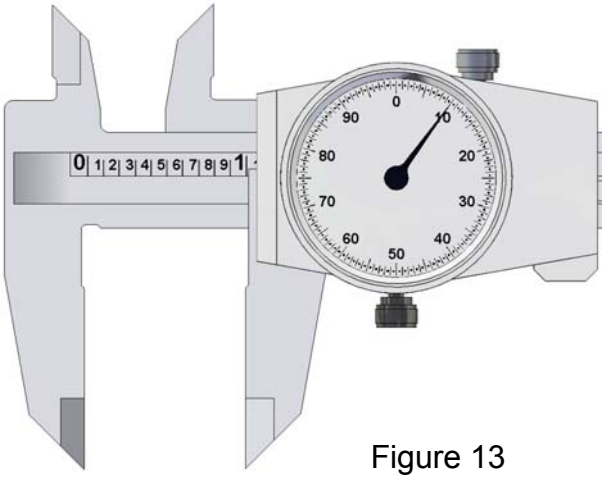


Figure 13

35. If an object is stressed beyond its elastic region, it will _____ when the stress is removed.

A. break
B. return to its original size and shape
C. be permanently deformed
D. cool down

36. A material that experiences very little plastic deformation prior to rupture or fracture would be referred to as a _____ material.

A. brittle
B. polymer
C. tensile
D. ductile

37. What is the strain value of a 10 inch long rod that has a cross-sectional area of 0.2 in^2, and that has elongated 0.05 inches?

A. 0.005
B. 0.02
C. 0.5
D. 2

38. If an engineer created an evaluation report that describes why a levy failed during a hurricane, it would likely be presented as a(an) _____.

A. abstract.
B. design brief.
C. case study.
D. essay.

39. The phenomenon that allows any projectile in motion to come back to rest on the ground is _____.

A. moment of inertia.
B. displacement of projectile.
C. initial velocity.
D. acceleration due to gravity.

40. When a projectile is thrown, the _____ component of its velocity will remain constant throughout its flight.

A. horizontal
B. Y
C. vertical
D. Z

POE Exam Reference Tables

Circular Shapes

Formulas	*Variables*
$C = \pi D$ $A = \pi r^2$	C = circumference π = pi D = diameter A = area r = radius

Electrical Systems

Formulas	*Variables*
E = IR	E = voltage I = current R = resistance

Mechanisms

Formulas	*Variables*
MA = R ÷ E Lever MA = LE ÷ LR Wheel and Axle MA = LE ÷ LR Pulley MA = Total number of strands supporting the load Inclined Plane or Wedge MA = L ÷ H Screw MA = C ÷ SP SP = 1 ÷ TPI	MA = Mechanical Advantage R = resistance force E = effort force LE = distance to effort LR = distance to resistance L = slope length H = slope height or width thickness C = circumference SP = screw pitch TPI = threads per inch

Statics

Formulas	*Variables*
M = FD	M = moment about a point F = force D = perpendicular distance

Static Equilibrium

Formulas	*Variables*
$\sum F_X = 0 = X(right) - X(left)$ $\sum F_Y = 0 = Y(up) - Y(down)$ $\sum M = 0 = CCW - CW$	$\sum$ = sum F = force M = moment about a point CCW = counter-clockwise CW = Clockwise

Properties of Materials

Formulas	*Variables*
$\sigma = P \div A$ $\in = \delta \div L$ $\delta = PL \div AE$ $E = \sigma \div \in$ $E = (P_1 - P_2)L_0 / (\delta_1 - \delta_2)A$	δ = total deformation σ = stress $\in$ = strain E = modulus of elasticity, Young's Modulus P = axial force A = area

Right Triangle Ratios

Formulas	*Variables*
sin θ= opposite / hypotenuse cos θ= adjacent / hypotenuse tan θ= opposite / adjacent	θ = angle

Gear Ratios

Formulas	*Variables*
	GR = gear ratio
GR = Input Rate / Output Rate SR = Win / Wout Win / Wout = Dout / Din Tin / Tout = Din / Dout	N in = number of teeth on driver gear N out = number of teeth on driven gear D in = driver gear diameter, in D out = driven gear diameter, in W in = driver gear speed, rpm W out = driven gear speed, rpm T in = torque of driver gear, ft lbs. T out = torque of driven gear, ft lbs. SR = speed ratio

Kinematics

Formulas	*Variables*
$x = \frac{V_i^2 \sin 2\theta}{g}$	v_i = initial velocity θ = angle g = gravity x = range