Seat No.: _____

Republic of the Philippines
PROFESSIONAL REGULATION COMMISSION
Manila

39/50

BOARD OF AERONAUTICAL ENGINEERING

AERONAUTICAL ENGINEERS Licensure Examination
Tuesday, November 12, 2019 08:00 a.m. - 12:00 noon

AERODYNAMICS SET A

INSTRUCTION: Select the correct answer for each of the following questions. Mark only one answer for each item by shading the box corresponding to the letter of your choice on the answer sheet provided. STRICTLY NO ERASURES ALLOWED.

MULTIPLE CHOICE

1. A tank for use in a supersonic wind tunnel contains air with a pressure of 20 atm. The temperature inside the tank is 521 deg R. The volume of the tank is 1,500 cu ft. What is the mass of the air inside the tank in kilogram?
   A. 805
   B. 986
   C. 1,195
   D. 1,036

2. An airplane is able to execute a turning maneuver due to
   A. centrifugal force.
   B. movement of rudder, aileron and elevator.
   C. horizontal component of lift.
   D. deflection of flaps and spoilers.

3. An airplane is flying such that the pressure at point X on its wing is measured equal to 3,000 psf, assuming standard sea-level conditions. Find the temperature in deg R at point X.
   A. 750.1
   B. 573.5
   C. 689.7
   D. 612.2

4. Which of the following statements is correct?
   A. Phugoid motion occurs at nearly constant speed and angle of attack.
   B. A lagging tab increases stick-free maneuvering stability.
   C. Short-period motion occurs at nearly constant speed and varying angle of attack.
   D. The hinge moment generated by the elevator tab is constant.

5. An airplane is flying such that the pressure at point X on its wing is measured equal to 3,000 psf, assuming standard sea-level conditions. What is the pressure at point 9 in psi, assuming standard sea-level conditions?
   A. 15.9
   B. 10.6
   C. 8.7
   D. 3.5

6. What true velocity (in kts) is a high-speed reconnaissance plane maintaining at Mach = 3.0 cruise at 65,000 ft on a standard day?
   A. 1,470
   B. 1,142
   C. 1,581
   D. 1,718

7. An airplane whose service ceiling is 4,267 meters, climbs at 4.84 meters/sec at sea level. How long (in sec) will it require to climb from sea level to 2,438 meters if its rate of climb varies linearly with altitude?
   A. 849
   B. 987
   C. 705
   D. 607

Continued on Page 2

AERODYNAMICS SET A

8. Lift and drag of airfoils usually go together to some extent.
   A. Positive air pressure below the wing surface and negative air pressure above it.
   B. Positive air pressure below and above the wing surface.
   C. Negative air pressure below the wing surface and positive air pressure above it.
   D. Negative air pressure below and above the wing surface.

9. A barometer filled with mercury is exposed to an atmospheric pressure of 2116 lb/sq ft. What is the height of the column of mercury in the barometer (in inches)?
   A. 30.67
   B. 29.92
   C. 25.91
   D. 27.50

10. The coefficient of kinematic viscosity is the ratio of the coefficient of viscosity to the
   A. pressure.
   B. volume.
   C. velocity.
   D. density.

11. Changes in magnitude of total rotor thrust of the main rotor during cruise are achieved by _____
   A. combined rotor speed change and blade pitch change
   B. altering the pitch of the main rotor blades collectively while the rotor speed is kept constant.
   C. varying the speed of the main rotor, while the pitch of the blade is constant
   D. changing the speed of the air velocity around the blade

12. What is the correct sequence for selecting maximum RPM on a constant-speed propeller-driven airplane?
   A. Throttle back, slowly move the propeller to maximum RPM, and then reduce the airspeed.
   B. Slowly move the propeller to maximum RPM, throttle back, and then reduce airspeed.
   C. Throttle back, reduce airspeed, and then slowly move the propeller to maximum RPM.
   D. Reduce airspeed, slowly move the propeller to maximum RPM, and then throttle back.

13. Boeing 737-300 aircraft is flying at a flight level of 27,000 ft on its flight to Bacolod. With its cruising speed of 420 knots, compute for its Mach number.
   A. 0.70
   B. 0.65
   C. 0.57
   D. 0.45

14. A water pump discharges 75 gallons/min. Assuming the specific weight of water is 61.5 lb/cu ft, calculate the mass flow rate (in lb/min).
   A. 742.3
   B. 321.5
   C. 621.2
   D. 520.4

15. In which direction does the aircraft nose move if the rudder is deflected to the left?
   A. The aircraft nose moves to the left.
   B. The aircraft nose moves to the right.
   C. The aircraft nose moves downwards.
   D. The aircraft nose moves upwards.

16. In a fixed propeller, what happens to the angle of attack of the blade if forward speed increases?
   A. Goes to zero.
   B. Increases.
   C. Decreases.
   D. Remains fixed.

Continued on Page 3

MATHEMATICS

AERODYNAMICS SET A

17. In a NACA four-digit-series airfoil, the last two digits are the
A. maximum camber in percent chord.
B. location of the maximum thickness in percent chord.
C. location of the maximum camber in tenths of chord, measured from the leading edge.
D. maximum thickness in percent chord.

18. An Airbus A320 is flying at 35,000 ft to Hongkong. Determine the ambient density (kg/cu meter) at that altitude.
A. 0.45
B. 0.51
C. 0.38
D. 0.63

19. If the speed of the air is increased by four times, its dynamic pressure _____.
A. doesn't change
B. rises to maximum value
C. increases by 16 times
D. increases by 4 times

20. Aircraft X levels off at 5,000 ft. An instrument reads 12.8 psi as measured by a pitot tube. Determine the standard density (slug/cu ft) of the air at that altitude.
A. 0.015
B. 0.006
C. 0.009
D. 0.011

21. A horizontal pipe, 1 ft in diameter, tapers gradually to 8 inches in diameter. If the flow is 500 cu ft of water per minute, what is the difference between the pressures in psf at the two sections? (Water weighs 62.4 lb per cu ft.)
A. 443
B. 672
C. 596
D. 784

22. The angle between the wing chord line and the direction of the relative wind is called
A. flight path angle.
B. angle of incidence.
C. angle of attack.
D. descent angle.

23. Which one of the following statements is true?
A. Phugoid motion occurs at a nearly constant speed with varying angles of attack.
B. Short-period motion occurs with varying speeds and angles of attack.
C. Phugoid motion occurs at a nearly constant angle of attack with varying speeds.
D. Short-period motion occurs at a nearly constant angle of attack at varying speeds.

24. A water pipe 8 inches in diameter gradually tapers down to 4 inches in diameter. The rate of flow is 135 cu ft per minute. If the pressure is 20 psi where the diameter is 8 inches, what is the pressure (in psi) where the diameter is 4 inches? (Water weighs 62.4 lb per cu ft.)
A. 28.2
B. 15.8
C. 45.3
D. 36.9

25. A high-speed jet fighter is flying at an altitude of 8 km. A pitot tube on the wing tip measures a pressure of 50 kPa. Calculate the true airspeed of the jet fighter (in meters/sec).
A. 227.2
B. 218.9
C. 235.4
D. 240.7

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AERODYNAMICS SET A

26. Asymmetrical thrust is greater when the _____ engine is inoperative.
   A. center, back
   B. center, front
   C. right
   D. left

27. What is the purpose of wing fences?
   A. Wing fences prevent the change from a laminar boundary layer to a turbulent boundary layer on laminar profiles.
   B. Wing fences prevent an increase of the boundary layer at the wing tips of swept wings.
   C. Wing fences prevent the change from a turbulent boundary layer to a laminar boundary layer on turbulent profiles.
   D. Wing fences enable an elliptical lift distribution.

28. On a geometrically twisted wing, the camber of the profile is _____.
   A. the same at the root and at the tip but the angle of incidence is greater at the tip
   B. greater at the root than at the tip and the angle of incidence is the same across the wing span
   C. the same at the root and at the tip but the angle of incidence is greater at the root
   D. less at the root than at the tip and the angle of incidence is the same across the wing span

29. When an aircraft undergoes maneuvers that interact high lateral stability (roll) with low directional stability (yaw), the resulting effect is _____.
   A. nose down
   B. tuck under
   C. dutch roll
   D. spiral dive

30. A heavy and light aircraft are flown at the maximum lift-drag ratio. Would the heavy aircraft glide at the same distance as the light aircraft?
   A. No, because the light aircraft glides faster than the heavy aircraft.
   B. No, because the glide range changes with altitude.
   C. Yes, because glide range does not vary with weight.
   D. Yes, because the heavy aircraft glides at the same speed as the light aircraft.

31. The drag force of a rotor blade is opposed by _____.
   A. torque
   B. rotor vibration
   C. rotor RPM
   D. blade flapping

32. Aircraft X levels off at 5,000 ft. An instrument reads 12.8 psi as measured by a pitot tube. How much faster (knot) does aircraft X truly fly than what is shown on its instrument?
   A. 16
   B. 28
   C. 20
   D. 12

33. A convergent duct has an inlet area of 5 sq. ft. Air enters the duct at 26 meters/sec and exits at 32 meters/sec. What is the exit area in sq ft?
   A. 5.6
   B. 6.7
   C. 7.8
   D. 4.1

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AERODYNAMICS SET A

34. Which high-lift devices installed on aircraft wings are considered the most efficient?
A. Slotted flaps and slats
B. Plain flaps and slats
C. Fowler flaps and slats
D. Kruguer flaps and slats

35. An airplane is flying at an altitude where the density is 0.0008907 slug/cu ft. The airplane has the following data: airplane weight 73,000 lb, wing area 950 sq ft, aspect ratio 5.92, zero-lift parasite drag coefficient 0.015, and the K value is 0.08. Calculate the minimum thrust required (in lb).
A. 4,824
B. 5,169
C. 4,921
D. 5,059

36. The quantity aircraft gross weight divided by the wing area is called
A. weight loading.
B. wing loading.
C. gross loading.
D. span loading.

37. What remains if the equipped empty weight of the aircraft is subtacted from its zero fuel weight?
A. Payload
B. Ramp weight
C. Cargo
D. Gross weight

38. The distance required for the pilot to accelerate to lift-off speed, discontinue the takeoff, and then bring the airplane to a complete stop on the runway is called the
A. ground distance.
B. takeoff distance.
C. accelerate-stop distance.
D. roll distance.

39. Aircraft Z is cruising at 7,000 meters. A pitot tube measures a pressure of 43,000 Pa. Compute for the ambient temperature (deg K) at that altitude.
A. 243
B. 231
C. 226
D. 218

40. A jet fighter, Having a wing area of 164 sq ft,wing span 30.5 ft, and span efficiency factor 0.8, generates a lift of 15,000 lb. Calculate the induced drag coefficient if the aircraft flies with a velocity of 269 miles/hr at standard sea-level conditions.
A. 0.027
B. 0.047
C. 0.017
D. 0.037

41. A monoplane maneuvers with _____ set/s of wings.
A. one
B. three
C. two
D. four

42. Consider a supersonic wind tunnel. The reservoir parameters are: air temperature 1013 deg K and air pressure 12 atm. Calculate the air density (kg/cu meter) at the reservoir.
A. 4.2
B. 6.8
C. 5.9
D. 3.6

43. To move the flight control surfaces in a modern airliner, multiple hydraulic systems are used. Why?
A. One system is required to extend the control surface while a nother system is used for retraction.
B. Because single hydraulic systems cannot supply the power nec essary to move the control surfaces.

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C. Because each control surface requires its own hydraulic system.
D. To minimize the impact of the loss of any one hydraulic system.

44. The service ceiling of an airplane is 6,492 meters. The rate of climb at sea level is 4.84 meters/sec. What is the rate of climb (in meter/sec) at 3,962 meter-altitude if it climbs linearly with altitude?
A. 2.2
B. 3.4
C. 1.3
D. 4.9

45. An airplane climbs in a certain time to 671 meters. In twice that time it climbs to 1,158 meters. What is the ceiling (in meter) if it climbs linearly with altitude
A. 2,673
B. 2,209
C. 2,447
D. 2,879

46. An airplane is flying such that the pressure at point X on its wing is measured equal to 3,000 psf, assuming standard sea-level conditions. What is the temperature in deg C at point X?
A. 45
B. 69
C. 30
D. 54

47. Consider an airplane weighing 15,500 lb maximum with the wing area equal to 400 sq ft, span 55 ft, parasite drag coefficient 0.02, and Oswald efficiency factor equal to 0.85. Calculate the thrust required (in lb) when the airplane is flying at 450 ft/sec at standard sea-level conditions.
A. 2,049
B. 2,445
C. 2,245
D. 2,667

48. The wing of an aircraft operating at 10,000 ft on a standard day has a stagnation point where the pressure is 100 lb/sq ft higher than atmospheric pressure, and a maximum velocity point where the pressure is 200 lb/sq ft lower than atmospheric. Assume that Bernoulli's equation applies. What is the free stream velocity (in ft/sec)?
A. 338
B. 201
C. 380
D. 279

49. A round pipe with a diameter of 5 feet at one end gradually decreases in diameter at the other end. The fluid velocity at the smaller end is 24 feet per second and the rate of increase in speed there is 13 ft/sec per foot run. Calculate the length of the pipe in ft if the cross-sectional area is reduced by 0.75 sq ft per foot length.
A. 68.2
B. 19.7
C. 24.3
D. 46.7

50. How do you calculate the all-important aircraft useful load?
A. Add the ramp weight and the gross weight.
B. Subtract the equipped empty weight from the ramp weight.
C. Divide the takeoff weight by the cargo load.
D. Multiply the weight factor with the maximum takeoff weight.

*** E N D ***

WARNING: **Failure to submit your Test Questions (Complete) set will cause the cancellation of your Test-Results for the subject.**

Seat No.: _____

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BOARD OF AERONAUTICAL ENGINEERING

AERONAUTICAL ENGINEERS Licensure Examination
Tuesday, November 12, 2019 02:00 p.m. - 05:00 p.m.

MATHEMATICS SET A

INSTRUCTION: Select the correct answer for each of the following questions. Mark only one answer for each item by shading the box corresponding to the letter of your choice on the answer sheet provided. STRICTLY NO ERASURES ALLOWED.

MULTIPLE CHOICE

1. What angle (degree) does the line y = -4x + 3 make with the reference line (y = 3x - 4)?
   A. -48.64
   B. 32.47
   C. -24.28
   D. 38.64

2. You deposit your money in a bank at 12 percent simple ineterest. How much will your money be at the end of 2 years if you deposited P25,000.00?
   A. P30,000
   B. P28,000
   C. P31,000
   D. P29,000

3. On a scale drawing A is 5 mm and B is drawn 11 mm. If the actual size of B is 5 meters, then the size (in meters) of A is
   A. 5
   B. 2 and 3/11
   C. 10
   D. 4 and 6/11

4. Find the groundspeed (mph) for the specified airspeed, heading and wind: airspeed = 180 mph, heading 290 deg, wind 30 mph, from 80 deg.
   A. 120
   B. 207
   C. 462
   D. 389

5. A guy wire 78 ft long runs from the top of a telegraph pole 56 ft high to the ground and pulls on the pole with a force of 290 lbs. What is the horizontal pull (in lbs) of the wire on the top of the pole?
   A. 452
   B. 567
   C. 378
   D. 202

6. Between 2:00 noon and 2:00 PM, the population of a certain bacteria triples. When will the population be 27 times what it was at 12:00 noon?
   A. 6:00 PM
   B. 8:00 PM
   C. 4:00 PM
   D. 3:00 PM

7. If a man can run P km in X hours, how long (in hours) will it take to run Q km at the same rate?
   A. PX/Q
   B. QX/P
   C. Q/PX
   D. PQ/X

8. An artillery observer in a captive balloon 2700 feet above his guns observes that the angle of depression of an enemy's fort is 27 deg 56 min. Find the distance (in feet) from the guns to the fort, if they lie at the same elevation.
   A. 3287
   B. 5092
   C. 6392
   D. 4591

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40. The area bounded by ... x = ...

MATHEMATICS SET A

9. Lucas can plow the field in 5 days while his father can do it in 2 days. How many days will they require working together?
   A. 3 and 2/7
   B. 1 and 3/7
   C. 2 and 1/7
   D. 4 and 4/7

10. Compute for the coordinates of the point P that is 1/3 of the way from Q1(25,15) to Q2(10,5).
   A. P(87/3,32/2)
   B. P(84/3,34/3)
   C. P(85/4,35/3)
   D. P(86/4,35/2)

11. A man wishes to raise a 300-lb weight to the top of a wall 15 ft high by dragging the weight up an incline. What is the length (in ft) of the shortest inclined plane he can use if his pulling strength is 135 lbs?
   A. 33.3
   B. 13.7
   C. 22.5
   D. 49.1

12. The fourth root of 100 is _____.
   A. square root of 10
   B. square root of 5
   C. cube root of 5
   D. cube root of 10

13. The volume of a sphere varies directly as the cube of its radius. The volume of a sphere with 4-inch radius is 100 cu inches. What is the ratio of proportionality?
   A. 1.56
   B. 2.31
   C. 4.63
   D. 3.47

14. What is the general solution to this differential equation, [(d exp2) y / d(x exp2)] - [dy / dx] - 12y = 0? (Note: exp means exponent or raised to)
   A. A [e exp(4x)] + B [e exp(-3x)]
   B. A cos 4x + B sin 3x
   C. A cos 3x + B sin 4x
   D. A [e exp(-4x)] + B [e exp(3x)]

15. If x and y are integers, for which of the following ordered pairs (x,y) is 3x+2y an odd integer?
   A. (2,-5)
   B. (-1,3)
   C. (4,1)
   D. (6,3)

16. The equation x + 3y = 9 and the equation 2x + 6y = 18 are plotted on the same graph chart. All of the following points will lie on both graphs EXCEPT
   A. (12,1)
   B. (6,1)
   C. (0,3)
   D. (9,0)

17. The number of children living in a town is 46 percent of the population or 3,610 of the people living in the town. How many people are living in the town?
   A. 6,054
   B. 7,848
   C. 8,941
   D. 9,625

18. If z = 3x exp2 cos y and x and y are functions of t alone, then dz/dt is _____. (Note: exp means exponent or raised to)
   A. (6x cos y) dx/dt - [3(x exp2) sin y] dy/dt
   B. (6x cos y) dy/dt + [3(x exp2) sin y] dx/dt
   C. (6x cos y) dy/dt - [3(x exp2) sin y] dx/dt
   D. (6x cos y) dx/dt + [3(x exp2) sin y] dy/dt

Continued on Page 3

SET A

MATHEMATICS

19. If segment MS is parallel to the y-axis and its midpoint is on the x-axis, then find the coordinate of S if M is at (a,b).
A. (-a,-b)
B. (-a,b)
C. (a,-b)
D. (0,0)

20. A ship sails, or an airplane flies, from A to B and the navigator then wishes to change his heading to point straight at C. Find the distance (in miles) of C from B, when AB = 250 miles, S 57 deg 40 min W, then C is 350 miles west and 30 miles north of A.
A. 300
B. 200
C. 215
D. 325

21. It refers to a conic section whose set of points are equidistant from a fixed point and a fixed line.
A. Hyperbola
B. Parabola
C. Line
D. Circle

22. If the two-digit number has x for its unit's digit and y for its ten's digit, represent the number.
A. x+y
B. x-y
C. 10y+x
D. 10x-y

23. Two cities are 800 km apart. At 4:00 PM, Train A leaves one city, traveling towards the other city, at a speed of 600 km per hour. At 5:00 PM the same afternoon, Train B leaves the first city, traveling in the same direction at a rate of 800 km per hour. Which of the following represents the actual result?
A. Train A arrives first, by an hour or more.
B. Two trains arrive at exactly the same time.
C. Train A arrives after Train B, by less than an hour.
D. Train A arrives first, by less than an hour.

24. Given are two lines L1 and L2 with slopes 1/8 and 5/9, respectively. Find the tangent of the angle θ from the line L1 to the line L2.
A. 36/79
B. 33/76
C. 39/78
D. 31/77

25. The integral of y=x cubed-x+1 is...
A. (x raised to the 4th)/3-(x squared)/2+1+c.
B. (x cubed)/3-(x squared)/2+x.
C. (x raised to the 4th)/4-(x squared)/2+x+c.
D. (x squared)/3-1+c.

26. Add 70 mm+3 meters+2 cm and express in meters.
A. 3.09
B. 3.0009
C. 3.9
D. 3.009

27. Robert has 12 coins totaling P1.45. NONE of his coins is larger than a twenty-five centavo coin. Which of the following CANNOT be the number of 25-centavo conis that he has? The coins are composed of 25-centavos, 10-centavos and 5-centavos.
A. 5
B. 1
C. 2
D. 3

28. The surface area of a sphere, initially zero, increases uniformly at the rate of 4 sq cm/sec. Find the rate (cm/sec) at which the radius is increasing at the end of 2 sec.
A. 0.40
B. 0.10
C. 0.30
D. 0.20

Continued on Page 4

SET A

MATHEMATICS

29. What is the value of x if log (23) exp (1/x) = 1? (Note: exp means exponent or raised to)
    A. 5.75
    B. 2.26
    C. 3.5
    D. 0.17

30. A piece of artillery at G is firing at T from a range of 15,000 yards. An airplane observer telephones to G that a shot fell at S, 500 yards to the right and 400 yards beyond T. Find the corrections in range (yards) which should be applied for future shots.
    A. Reduce by 410
    B. Reduce by 553
    C. Reduce by 778
    D. Reduce by 672

31. Solve for x given the two equations: 5x-y+1=0 and 3x+6y-4=0.
    A. -4/35
    B. 4/35
    C. 2/33
    D. -2/33

32. Taxi no.1 started 2.5 hours before taxi no.2 which had a speed of 83 kph. After traveling for 3.6 hours, taxi no.2 overtook taxi no.1. What was the speed of taxi no.2 in kph?
    A. 55
    B. 63
    C. 78
    D. 49

33. An ellipse has the equation (x squared/100)+(y squared/64)=1. Determine the distance from the center to a vertex.
    A. 13
    B. 15
    C. 17
    D. 10

34. If the perimeter of the rhombus ABCD is 64 and BD is 4 x sq root of 15, find AC.
    A. 14
    B. 21
    C. 16
    D. 28

35. The simultaneous equations: 3x + y - z = 14, x + 3y - z = 16, x + y - 3z = -10 have the solution
    A. x = -5, y = -6, z = -35
    B. x = 5, y = 7, z = 8
    C. x = -5, y = -6, z = -39
    D. x = 6, y = 6, z = 10

36. A ship, 600 miles away from A with the bearing 72 deg from A, is sailing on course 190 deg at a speed of 25 knots. If planes are dispatched from A to intercept the ship, how far (miles) from A will the interception occur?
    A. 457
    B. 326
    C. 273
    D. 579

37. A piece of wire 100 cm long is to be cut to pieces, and those two pieces are each to be bent to make a square. The area of one square is to be 225 sq cm greater than the other. What is the sum of the areas (sq cm) of the two squares?
    A. 289
    B. 256
    C. 392
    D. 353

38. Solve for y in the equation: 7(y squared)=18+3(y squared).
    A. + or -2.48
    B. + or -2.12
    C. + or -2.57
    D. + or -2.39

39. The sides of a triangle are 12, 8 and 15 inches long. In a similar triangle, the longest side is 40 inches long. Of the other two sides, what is the measure of the shorter side in inches?
    A. 27.8
    B. 21.3
    C. 15.4
    D. 18.6

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40. The area bounded by the refera- x = 0 to x = 3 is

SET A

SET A

MATHEMATICS

40. The area bounded by the reference curve (y = x exp2) and the x axis from x = 0 to x = 3 is _____. (Note: exp means exponent or raised to)
A. 7
B. 11
C. 9
D. 4

41. A certain rectangle is w units long on a side. The other side measures 15 units less than 4 times as long. Solve for the perimeter of the rectangle.
A. 5(w - 15)
B. 10(w - 5)
C. 5(w - 10)
D. 10(w - 3)

42. If a body has fallen s feet without initial vertical velocity in a vacuum near the earth's surface, the body's vertical velocity v in ft/sec is given by v squared = 2gs, where g = 32.16. Under the assumptions of such a fall, what is the velocity of a parachutist (in ft/sec) who has fallen 4000 ft before opening his parachute?
A. 679.14
B. 507.22
C. 369.19
D. 402.11

43. What is the focal distance of the parabola with the equation y squared=-20x?
A. 4
B. 5
C. 7
D. 6

44. Find the length (in ft) of the arc subtended by a central angle of 35 deg in a circle whose radius is 20 ft.
A. 12.2
B. 15.1
C. 10.7
D. 13.9

45. The volume of a fixed mass of a perfect gas at constant temperature is inversely proportional to the pressure. If the volume is 8 liters when the pressure is 3 atm, find the volume (in liters) when the pressure is 5 atm.
A. 6.7
B. 4.8
C. 5.2
D. 5.6

46. What is the length (in cm) of the shortest side of a right triangle if its hypotenuse is 30 cm and its perimeter is 72 cm?
A. 16
B. 19
C. 18
D. 17

47. If the heading of an airplane is 60 deg and its airspeed is 250 mph, while a wind of 40 mph is blowing from 200 deg, find the drift angle.
A. 12 deg 37 min
B. 3 deg 10 min
C. 17 deg 43 min
D. 5 deg 14 min

48. A regular polygon has 54 diagonals. How many sides does the polygon have?
A. 10
B. 12
C. 9
D. 8

49. A piece of artillery at G is to fire at an invisible target T. An observer at B can see both G and T; with instruments he measures BT, BG and their azimuths. BG = 2080 yards, azimuth = 38 deg 20 min; BT = 5380 yards, azimuth = 284 deg 50 min. Find the azimuth of T from G.
A. 190 deg 23 min
B. 187 deg 54 min
C. 200 deg 12 min
D. 267 deg 42 min

Continued on Page 6

50. Divide 50 into two parts with the ratio 1:4. What is the ratio of the larger part?

A. 40
B. 20
C. 25
D. 30

*** E N D ***

WARNING: **Failure to submit your Test Questions (Complete) set will cause the cancellation of your Test-Results for the subject.**

Seat No.: _____

Republic of the Philippines
PROFESSIONAL REGULATION COMMISSION
Manila

35/50

BOARD OF AERONAUTICAL ENGINEERING

AERONAUTICAL ENGINEERS Licensure Examination
Wednesday, November 13, 2019 08:00 a.m. - 12:00 noon

AIRCRAFT STRUCTURE & DESIGN SET A

INSTRUCTION: Select the correct answer for each of the following questions. Mark only one answer for each item by shading the box corresponding to the letter of your choice on the answer sheet provided. STRICTLY NO ERASURES ALLOWED.

MULTIPLE CHOICE

1. Passenger access doors are normally located in the _____ side of the airplane.
   A. Aft
   B. Port
   C. Front
   D. Starboard

2. This feature gives the front view of the airplane a "droop wing" effect.
   A. Negative dihedral
   B. Positive dihedral
   C. Sweepback angle
   D. Angle of incidence

3. Due to the complexity of the structure of the fuselage and the arrangement of interior, it is customary to build a:
   A. Full scale prototype
   B. Trial Aircraft
   C. Dummy
   D. Full scale mock-up

4. Activity factor, airfoils, pitch distribution, tip Mach number and disk loading are some factors which affect:
   A. Propulsion efficiency
   B. Engine efficiency
   C. Propeller efficiency
   D. Airfoil efficiency

5. Failure due to repeated application of loads.
   A. Dynamic failure
   B. Fatigue failure
   C. Bearing failure
   D. Stress failure

6. What parameters affect Reynolds number?
   A. Temperature and pressure
   B. Density and viscosity
   C. Temparature and volume
   D. Density and temperature

7. With the aircraft in flight, ice formation on propellers will
   A. decrease thrust and cause excessive vibration.
   B. increase aircraft stall speed and increase noise.
   C. increase thrust and will not cause too much vibration.
   D. decrease aircraft stall speed and increase noise.

8. What is the force that moves the aircraft through the air and is provided by the propellers or the jet engines?
   A. Thrust
   B. Resultant
   C. Lift
   D. Drag

9. As per FAR part 23, the Negative Limit Manuevering Load Factor for an acrobatic category airplane need NOT be less than
   A. -0.6 (+n)
   B. -0.4 (+n)
   C. -0.5 (+n)
   D. -0.3 (+n)

10. Measure of kinetic energy in a moving gas or fluid.
    A. impulse
    B. static pressure
    C. ram force
    D. Dynamic pressure

Continued on Page 2

AIRCRAFT STRUCTURE & DESIGN SET A

11. Metals such as aluminum, steel, and titanium are referred to as:
A. Multi phase materials
B. Composite Materials
C. None of these is correct
D. Single-phase materials

12. All engines and other heat generating equipments must be isolated from the rest of the airplane by means of:
A. Firewall
B. Nacelle
C. Bulkhead
D. Engine mounts

13. Accessibility of engine components in an engine can best be provided using;
A. rear opening door
B. forward opening door
C. clamshell door
D. shutter door

14. Which of the primary flight controls achieve yaw control?
A. Rudder
B. Spoilers
C. Ailerons
D. Elevator

15. As guideline the take off climb speed should not be greater than or equal to:
A. 1.1 X Stalling speed
B. 1.3 X stalling speed
C. 1.2 X stalling speed
D. Stalling speed

16. Payload can include:
A. baggage
B. passenger
C. all of these
D. cargo

17. This is provided in the lowest point of a fuel system to eliminate condensed water from the tank.
A. vent system
B. dumping system
C. surge tanks
D. drainage system

18. Which of the parameters can be changed by the pilot through the use of controls in the cockpit?
A. Pitch angle
B. Angle of attack
C. Angle of incidence
D. Dihedral angle

19. A wing slat is a movable airfoil attached to the leading edges of high-performance airplane wings. Their purpose is to
A. replace flaps
B. act as a dive brake or speed brake
C. increase speed on take off
D. reduce stalling speed

20. A rapid-climbing airplane should have:
A. high drag
B. low power loading
C. low lift
D. high wing loading

21. Which of the following should exist for an airplane to be balanced in flight?
A. Resultant forces are acting in the CP.
B. Pitching moments about the center of gravity (CG) is zero.
C. Thrust line acts on the CG.
D. Pitching moments about the center of pressure (CP) is zero.

22. This type of spars is widely used or adapted in modern wing design because of its structural efficiency:
A. truss type
B. frame truss type
C. cap-lock type
D. shear web type

Continued on Page 3

23. Induced drag is normally reduced by the use of
A. wing fillet
B. wing camber
C. wing strut
D. wing fence

24. Find the load in member 1-5 in figure 15.
A. 150 lbs.
B. 100 lbs.
C. 200 lbs.
D. 300 lbs.

25. To determine the true outside air temperature, the indicated temperature should be corrected for:
A. position error
B. altitude error
C. compressibility error
D. pressure error

26. Stress acting on columns loaded axially.
A. Bending stress
B. Tensile stress
C. Compressive stress
D. Torsion

27. The equation for this type of drag is dependent on the amount of lift, the aspect ratio of the wing and the Oswald efficiency factor.
A. Skin friction drag
B. Induced drag
C. Interference drag
D. Profile drag

28. During inspection of the flight control system of an airplane equipped with differential-type aileron control, side-to-side movement of the control stick will cause
A. each aileron to have a greater down travel from the streamlined position than up travel.
B. The left aileron to move through a greater number of degrees from full up to full down than the right aileron.
C. each aileron to have a greater up travel from the streamlined position than down travel.
D. The right aileron to move through a greater number of degrees from full down to full up than the left aileron.

29. The speed corresponding to the intersection between the maximum gust intensity line and the gust envelope in a V-N diagram.
A. maximum manuevering speed
B. maximum gust intensity air speed
C. minimum manuevering speed
D. Minimum gust intensity air speed

30. Created through heat generated by forging under rotation force:
A. pressure welding
B. fussion welding
C. resistance welding
D. function welding

31. A _____ contributes to induced drag primarily because of its effect on wing span load distribution.
A. landing gear
B. fuselage
C. tail
D. wing

32. This system helps the pilot maintain a zero cockpit control forces in a given flight condition;
A. servo system
B. balanced system
C. trim system
D. pressure system

33. Engine inlet on a supersonic airplane is located _____ for favorable pressure interference.
A. above and forward of the wing
B. far aft under the wing
C. forward of the wing
D. far aft above the wing

Continued on Page 4

AIRCRAFT STRUCTURE & DESIGN SET A

34. What is the commonly used airframe structural material with excellent resistance to general surface corrosion and which can be used unprotected?
A. Aluminum
B. Low-metal alloys
C. Magnesium alloys
D. Titanium

35. What is the primary function of fuselage frames?
A. Maintain the shape of the fuselage and carry and distribute different loads, like shear and tension.
B. Carry vertical loads the wings transfer to the fuselage.
C. Support the engines mainly and also carry and distribute the engine thrust loads.
D. Withstand loads when the external pressure becomes higher th an cabin pressure.

36. Dividing the aerodynamic forces normal to the horizontal axis of the airplane by the weight will result to:
A. wing loading
B. power loading
C. thrust loading
D. flight load factor

37. If the designer is concerned in the ultimate performance of the aircraft in flight, he/she should be particularly interested in the _____ of the wing.
A. structural design
B. aerodynamic characteristics
C. design location
D. physical arrangement

38. Which of the following does NOT affect the weight of the wing?
A. Wing loading
B. Airfoil section
C. Drag factor
D. Aspect ratio

39. Empty weight is the manufacturer's empty weight plus
A. fuel
B. oil
C. fixed empty weight
D. trapped fuel and oil

40. Which statement is correct about boundary layer?
A. It is the layer of air in the area where the wings joins the fuselage producing interference drag.
B. The boundary layer is produced by the friction of the airflo w on the whole surface of the aircraft.
C. The boundary layer is the flow of air which is formed shortl y before the stall.
D. The airflow in the boundary layer always sticks to the surfa ce.

41. What is the basic source for the mechanical properties of aluminum alloys?
A. MIL-HDBK-5D
B. FAR Part 121
C. ICAO Annex 16
D. FAR Part 25

42. All factors being equal, how can you obtain a low landing speed?
A. lower wing loading
B. lower aspect ratio
C. lower thrust loading
D. lower maximum lift coefficient

43. The climb gradient of an aircraft is dependent on:
A. climb angle
B. angle of attack
C. wind
D. dihedral angle

Continued on Page 5

44. These tabs allow the pilot control forces to be "trimmed" at any flight condition.
A. ground adjustable tabs
B. blow down tabs
C. trim tabs
D. servo tabs

45. In an irrevesible flight control system the flight controls are moved by means of:
A. Cables
B. Push-pull rods
C. Gears
D. Actuators

46. The airplane must fly at _____ to obtain the maximum distance during a descent.
A. Maximum thrust
B. Minimum thrust
C. Minimum glide angle
D. Maximum glide angle

47. With a high aspect ratio of a full cantilever wing, the corresponding thickness ratio of the wing should be:
A. no change
B. greater
C. unity
D. lesser

48. Which of the following flight conditions is not true?
A. none of these is true
B. Approach: flaps and gear up, 50% power, approach speed trim
C. Climb: flaps for optimum climb, gear up, high power, best climb trim
D. Landing: flaps and gear down, power off, approach speed trim

49. To attain high ceiling, the airplane to be designed should have:
A. high aspect ratio
B. low lift
C. high drag
D. high wing loading

50. The center of gravity of the low wing monoplane should be located:
A. Along the thrust line
B. 2-6 inches below the thrust line
C. None of these is correct
D. 2-6 inches above the thrust line

*** E N D ***

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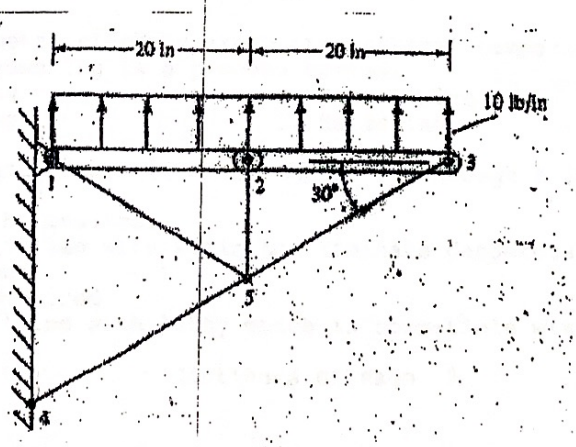

FIGURE 15

Seat No.: _____

Republic of the Philippines
PROFESSIONAL REGULATION COMMISSION
Manila

BOARD OF AERONAUTICAL ENGINEERING

43/50

AERONAUTICAL ENGINEERS Licensure Examination
Wednesday, November 13, 2019 02:00 p.m. - 05:00 p.m.

AIRCRAFT CONSTRUCTION, REPAIR & MODIFICATION SET A

INSTRUCTION: Select the correct answer for each of the following questions. Mark only one answer for each item by shading the box corresponding to the letter of your choice on the answer sheet provided. STRICTLY NO ERASURES ALLOWED.

MULTIPLE CHOICE

1. "Reheating" of a metal is the application of heat, usually to remove
   A. extreme hardness and brittleness
   B. carbon content
   C. cracks, voids or cold shuts
   D. the effects of heat treatment

2. The part of the aircraft which receives or encloses the landing gear as it retracts is
   A. wheel fairing.
   B. wheel well.
   C. wheel bay.
   D. engine pod.

3. When preparing an aircraft for weighing, which of the following should be filled unless otherwise noted in the aircraft specifications or manufacturer's instructions?
   A. Lavatory tanks
   B. Potable water containers
   C. Hydraulic reservoir
   D. Fluid reservoir for injection in the engines

4. Which aircraft reference is used to evaluate structural damages?
   A. SRM
   B. AMM
   C. TSM
   D. IPC

5. If a 50-pound tool applies +1500 inch-pounds to a reference axis, the tool is located _____ from the axis.
   A. +30
   B. +20
   C. -20
   D. -30

6. How many MS20426 DD 4-5 rivets will be required to attach a 10"x15" plate, using a singlerow of rivets, minimum edge distance, and 4D spacing?
   A. 52
   B. 56
   C. 45
   D. 50

7. Heating the metal slightly above its critical temperature and rapidly cooling by quenching is a process called:
   A. tempering
   B. Annealing
   C. Normalizing
   D. Hardening

8. Fiberglass damage that extends completely through a laminated sandwich structure
   A. may not be repaired
   B. must be filled with resin to eliminate dangerous stress conc entrations
   C. may be repaired
   D. may be filled with putty which is compatible with resin

Continued on Page 2

9. What is the four-digit SAE number of molybdenum steel, with 1% chromium and 0.30% carbon?
   A. SAE 4130
   B. SAE 2130
   C. SAE 1130
   D. SAE 3130

10. It is the maximum weight at which takeoff is permitted.
   A. Maximum ramp weight
   B. Maximum empty weight
   C. Maximum takeoff weight
   D. Maximum gross weight

11. The sharpest bend that can be placed in a piece of metal without critically weakening the part is called the
   A. minimum radius of bend
   B. nuetral radius of bend
   C. bend allowance
   D. maximum radius of bend

12. Which of the following methods may be suitable to use to detect cracks open to the surface in aluminum forgings and castings?

   (1) Dye penetrant inspection.
   (2) Magnetic particle inspection.
   (3) Metallic ring inspection.
   (4) Eddy current inspection.
   (5) Ultrasonic inspection.
   (6) Visual inspection.

   A. 1,2,3,4,5,6
   B. 1,2,4,5,6
   C. 1,5,6
   D. 1,4,5,6

13. A type of wing construction which holds fuel without the usual fuel tanks is
   A. moist wing
   B. wet wing
   C. dry wing
   D. box-beam wing

14. What is the internal force of a substance which opposes or resists deformation?
   A. Strain
   B. Shear
   C. Stress
   D. Compression

15. What heavy longitudinal members are usually extended across several bulkheads and formers to resist primary bending loads?
   A. Longerons
   B. Stiffeners
   C. Formers
   D. Bulkheads

16. Certain structural parts may be heat-treated and therefore could require special handling. In general, the more responsive an alloy steel is to heat treatment, the less suitable it is for
   A. brazing.
   B. bolting.
   C. riveting.
   D. welding.

17. When reading a blueprint, a dimension is given as 4.387 inches + 0.005, -0.002. Which of the following is true?
   A. The tolerance is 0.007.
   B. The tolerance is 0.004.
   C. The maximum acceptable size is 4.385 inches.
   D. The maximum acceptable size is 4.389 inches.

18. If the datum line is placed at the nose of an airplane rather than at the firewall or some other location aft of the nose, measurement arms will be _____.
   A. Zero
   B. In positive numbers
   C. Can be either positive or negative numbers depending on the manufacturer's preference
   D. In negative numbers

Continued on Page 3

AIRCRAFT CONSTRUCTION, REPAIR & MODIFICATION SET A

19. What type of stress exists in a material that is subjected to cyclic or repeated loading?
A. Tension stress
B. Fatigue stress
C. Torsional stress
D. Compression stress

20. It is the property of material that permits little bending or deformation without fracture.
A. Malleability
B. Ductility
C. Hardness
D. Brittleness

21. What type of corrosion may attack the grain boundaries of aluminum alloys when the heat treatment process has been improperly accomplished?
A. Concentration cell
B. Fretting
C. Intergranular
D. Fatigue

22. The structural member that attaches the nacelle to the wing is called
A. none of these
B. strut
C. pylon
D. spar

23. Which fasteners are used in areas which are accessible on one side only?
A. Taper bolts
B. Blind fasteners
C. Solid rivets
D. Tap screws

24. Repairing shallow scratches in sheet metal is made by:
A. patching
B. buffing
C. stop drilling
D. burnishing

25. Rivet identification, type AD rivets has dimple depressed dot on the head and colored yellow dichromate, it is also made up of:
A. 2117 AL
B. 1100 AL
C. 7050 AL
D. 2024 AL

26. Which steel parts are normally considered repairable by welding?
A. SAE 4130 chrome/molybdenum tubing.
B. Streamline wire braces
C. Tumbuckle ends
D. Brazed or soldered parts

27. When using a color contrast Dye Penetrant kit, and a small crack is suspected in the material:
A. Less inhibitor should be used.
B. A magnifying glass is recommended.
C. All of these process can be performed.
D. Less developer should be used.

28. Where is an AN clevis bolt used in an aircraft?
A. For tension and shear load conditions.
B. ONLY for shear load applications.
C. Where external tension loads are applied.
D. For control cables connection.

29. An aircraft's LEMAC and TEMAC are defined in terms of distance from _____.
A. Each other
B. The wing center of lift
C. The main wheels
D. The datum

30. An electrolyte from an aircraft nickel-cadmium spilled on aircraft structure is best nuetralize by:
A. liquid soap
B. water
C. boric acid
D. vinegar

Continued on Page 4

AIRCRAFT CONSTRUCTION, REPAIR & MODIFICATION SET A

31. One of the main advantages of honeycomb structure is that it
    A. is relatively fireproof
    B. is very strong because it is heavy
    C. does not require inspections
    D. is better able to withstand sonic vibration

32. What is considered the smallest element of a control cable?
    A. Rod C. Wire
    B. Strand D. Pulley

33. Find the empty weight C.G location for the following tricycle-gear aircraft. Each main wheel weighs 753 pounds, nosewheel weighs 22 pounds, distance between nosewheel and main wheels is 87.5 inches, nosewheel location is +9.875 inches from datum, with 1 gallon of hydraulic fluid at -21.0 inches included in the weight scale.
    A. +96.11 inches C. +97.45 inches
    B. +85.67 inches D. -85.67 inches

34. In weight and balance, to find the weight of the aircraft, the tare weight in reference to the scale reading shall be:
    A. added C. divided
    B. subtracted D. multiplied

35. An airplane should be rigged to fly hand-off at
    A. landing speed C. sea level
    B. cruising speed D. never-exceed speed

36. Joggles in removed rivet shanks would indicate partial
    A. Bearing failure C. Tear failure
    B. Shear failure D. Tension failure

37. Stepping or layering doublers at a repair and tapering of the repair parts will produce:
    A. increase fatigue cracking
    B. gradual load transfer
    C. aerodynamic consideration
    D. hard point

38. The minimum distance between centers of rivet holes is:
    A. 2 x rivet dia C. 5 x rivet dia
    B. 3 x rivet dia D. 4 x rivet dia

39. When locating FS 150, measure
    A. 150 inches aft of the buttock line
    B. 150 inches aft of the zero or fixed reference line
    C. 150 centimeters aft of the nose
    D. 150 inches forward of the empennage

40. The lenght of a rivet to be used to join a sheet of .032 inch and .064 inch aluminum alloy should be equal to
    A. two times the rivet diameter plus 0.032 inch
    B. one and one-half times the rivet diameter plus 0.096 inch
    C. two times the rivet diameter plus 0.064 inch
    D. three times the rivet diameter plus 0.096 inch

41. The shear strenght of an AN470DD-6-8 rivet, immediately after driving, is approximately 75 percent of its ultimate shear strenght. The remaining 25 percent is obtained by
    A. standing at ordinary room temperature for about 4 days (age harden)
    B. chilling the riveted unit for an hour
    C. shear loads imposed on the riveted assembly in use

Continued on Page 5

D. heating the unit in which the rivet was used to 960 F, holding for 3 hours, and allowing the unit to cool slowly until room temperature is reached

42. Alloy 2117 rivet are heat treated
A. to a temperature of 490 to 500 degrees C and quenched in cold water
B. by the manufacturer but require reheat treatment before being driven
C. by the manufacturer and do not require heat treatment before being driven.
D. to a temperature of 500 to 510 degrees C and quenched in cold water

43. Which number represents the Vernier caliper scale graduation of micrometer?
A. .01. C. .00001.
B. .001. D. .0001.

44. Magnetic particle inspection is used primarily to detect
A. flaws on or near the surface
B. surface cracks
C. deep subsurface flaws
D. distortion

45. When an aircraft is being weighed, the brakes should be:
A. Full on
B. Set to "park"
C. Set just enough to retard any tendency of the aircraft to move
D. Full off and wheel chocks should be used

46. What is the allowable manufacturing tolerance for a bushing where the outside dimensions shown on the blueprint are 1.0625 + 0.0025, -0.0003?
A. 0.0028 C. 1.0650
B. 0.0025 D. 1.0647

47. It refers to the weight of an item multiplied by its arm.
A. Moment C. Reference datum
B. Vertical axis D. Arm

48. Brinell hardness test is accomplished by the application of a standard load to a smooth surface of metal.
A. through a hardened steel ball, 1 cm. in diameter.
B. through a cylindrical steel shaft one cm. in diameter.
C. by pressing a small cylindrical pyramid diamond.
D. to set a hardened steel ball.

49. In cases of elongated bolt holes in a wood spar or crack in the vicinity of boltholes,
A. the spar may be reinforced by using birch reinforcing plates
B. it is permissible to plug the hole with hardwood and redrill
C. a plug should be inserted in the hole and a reinforcement plate added.
D. a new section of spar should be spliced in or the spar replaced entirely.

50. It is a test for material hardness in which a hardened steel ball, one centimeter in diameter, is pressed under a known pressure into a flat surface of the test specimen.
A. Moh C. Brinell
B. Tig D. Hooke

*** E N D ***

WARNING: **Failure to submit your Test Questions (Complete) set will cause the cancellation of your Test-Results for the subject.**

Seat No.: _____

Republic of the Philippines
PROFESSIONAL REGULATION COMMISSION
Manila

38/50

BOARD OF AERONAUTICAL ENGINEERING

AERONAUTICAL ENGINEERS Licensure Examination
Thursday, November 14, 2019 08:00 a.m. - 12:00 noon

AIRCRAFT POWER PLANT SET A

INSTRUCTION: Select the correct answer for each of the following questions. Mark only one answer for each item by shading the box corresponding to the letter of your choice on the answer sheet provided. STRICTLY NO ERASURES ALLOWED.

MULTIPLE CHOICE

1. A certain spring, when stretched, measures 15.5 cm requiring a work of 565 joules to do it. Its free lenght is 5.4 cm. What is the spring constant (in kN/meter)?
   A. 42.7
   B. 50.1
   C. 47.2
   D. 53.5

2. What is the function of turbines located at the rear section of a gas turbine engine?
   A. Increase air velocity
   B. Drive the compressor section
   C. Expand air pressure
   D. Drive the combustion chamber

3. What do you call the power produced by turboprop engines?
   A. Equivalent shaft horsepower
   B. Mechanical power
   C. Delivered horsepower
   D. Indicated horsepower

4. In a certain location, the barometer reads 13.45 psi and a pressure gage reads 86 psig. Solve for the absolute pressure in inches mercury.
   A. 238
   B. 203
   C. 217
   D. 225

5. A certain gas undergoes a process with the following conditions: initial pressure 400 kPa, initial volume 97 liters, final pressure 103 kPa, and final volume 270 liters. During the process the enthalpy decreases by 35.6 kJ. The specific heats are constant with specific heat at constant volume equal to 3.58 kJ/kg-deg K. Determine the specific heat at constant pressure (in kJ/kg-deg K).
   A. 5.2
   B. 6.9
   C. 3.1
   D. 4.2

6. If the gear ratio is 5:24, what is the speed of the driven gear (larger gear) if the driving gear is rotating at 1000 RPM?
   A. 4800 RPM
   B. 2408 RPM
   C. 180 RPM
   D. 208 RPM

7. Consider a rocket engine. The combustion chamber pressure and temperature are 20 atm and 3,279 deg K respectively. The area of the rocket exit is designed so that the exit pressure exactly equals ambient pressure at a standard altitude of 30 km, where the ambient pressure is 0.01174 atm. For the gas mixture of the fuels, assume that the specific heat ratio is 1.31. The gas constant as 519.6 J/kg-deg K. Calculate the exit Mach number.
   A. 5.58
   B. 5.77
   C. 4.58
   D. 3.35

Continued on Page 2

8. The length of the piston movement in a reciprocating engine is called:
   A. travel
   B. bore
   C. radial
   D. stroke

9. A cycle that consists of two isothermal and two isobaric process is called
   A. Ericsson cycle
   B. Carnot cycle
   C. Brayton cycle
   D. Sterling cycle

10. Calculate the pressure (in kPa) at the start of power stroke of an internal combustion engine, assuming the specific heats and gas constant for the fuel-air mixture are approximated by the air values alone. The temperature at the start of power stroke is 3,490 deg K. The temperature at the end of the compression stroke is 550 deg K. and the pressure at the end of the compression stroke is 15.5 atm.
   A. 9,966
   B. 9,725
   C. 9,001
   D. 9,335

11. Which of the following defines a compressor stage?
   A. Air pressure increased by 100%
   B. Air passes through a stator then a rotor
   C. Air passes through a fan then a stator
   D. Air pressure decreased by 50%

12. A large stone with a mass of 5 kg is thrown with a constant acceleration from rest to 25 km/hr in 5 sec. Calculate the acceleration (in meters/sec squared).
   A. 1.9
   B. 3.0
   C. 2.6
   D. 1.4

13. A thermometer reads 418 deg F. What is the reading in deg C?
   A. 856.3
   B. 214.4
   C. 623.4
   D. 456.8

14. A double acting 35.56 cm by 35.56 cm compressor is rotating at 100 rpm. What is the displacement volume (in cu meters/min)?
   A. 4.032
   B. 7.063
   C. 5.021
   D. 8.072

15. The thrust produced by a rotating propeller is a result of
   A. The angle of attack of a propeller and plane of rotation
   B. An area of decreased pressure immediately in front of the propeller blades
   C. An area of low pressure behind the propeller blades
   D. The angle of relative wind and rotational velocity of the propeller

16. By experience, it has been found that if the compression ratio of the internal combustion engine is much greater than 10.1, what may occur?
   A. Implosion
   B. Combustion
   C. Preignition
   D. Pulsing

17. What publication is used for guidance to determine whether a powerplant repair is major or minor?
   A. Pilot's handbook
   B. Aircraft owner's manual
   C. Airworthiness Directives
   D. 14 CFR 43

Continued on Page 3

AIRCRAFT POWER PLANT SET A

18. (1) During takeoff, propeller thrust is greatest if the blade angle of attack is low and the engine power setting is high.
(2) With the aircraft stationary, propeller thrust is greatest if the blade angle of attack is high and the engine power setting is high.

Regarding the above statements,
A. ONLY No. 1 is true
B. ONLY No. 2 is true
C. Both No.1 & No.2 are true
D. NEITHER of the statements are true.

19. Which Thrust rating is allowed for a limited time only?
A. Maximum Take-off Thrust
B. Maximum Climb Thrust
C. Maximum Cruise Thrust
D. Maximum Idle Thrust

20. Consider a rocket engine. The combustion chamber pressure and temperature are 20 atm and 3,279 deg K respectively.For the gas mixture of the fuels, assume that the specific heat ratio is 1.31. Calculate the specific heat at constant pressure (in J/kg-deg K) if the gas constant is given as 519.6 J/kg-deg K.
A. 2,357
B. 2,196
C. 2,299
D. 2,463

21. Consider an airplane, powered by a turbojet engine, flying at a standard altitude of 29,000 ft at a velocity of 455 miles/hr. Calculate the pressure (in lb/sq ft) at the altitude at which the aircraft is flying.
A. 682
B. 658
C. 677
D. 669

22. If the intake valve is open too early in the cycle of operation of a four stroke cycle engine, it may result in
A. backfiring into the induction system
B. engine quit
C. improper scavenging of exhaust gases
D. engine kickback

23. A fluid is under a pressure of 15.5 lb/sq inch and a temperature of 266 deg F. Find the velocity of sound (in ft/sec) in the fluid if the fluid is air.
A. 1,121
B. 1,321
C. 927
D. 1556

24. The recommended aircraft engine lubricants are _____.
A. Vegetable, mineral or synthetic based
B. Animal, mineral or synthetic based
C. Animal and vegetable based
D. Mineral or synthetic based

25. Find the absolute pressure inside a cylinder that reads 60 psig with a Hg manometer reading 76.2 cm.
A. 65.3 psia
B. 74.7 psia
C. 14.7 psia
D. 100 psia

26. Which feature distinguishes the exhaust valve from the intake valve of a reciprocating engine?
A. Exhaust valves side has no cooling fins
B. Intake valves has short stem
C. Exhaust valves are hollow
D. Intake valves has large diameter

Continued on Page 4

27. The maximum power is normally considered to be developed in a reciprocating engine with a fuel/air mixture of approximately _____.
A. 10:1
B. 12:1
C. 8:1
D. 15:1

28. Which of these conditions will cause an engine to have an increased tendency to detonate?
(1) High manifold pressure
(2) High intake air temperature
(3) Engine overheated
(4) Late ignition timing
A. 1,4
B. 1,2,3.
C. 3,4
D. 1,2,3,4

29. What operational force which tends to increase propeller blade angle?
A. Centripetal force
B. Thrust bending force
C. Centrifugal twisting force
D. Aerodynamic twisting force

30. The temperature of an ideal gas remains constant while the absolute pressure changes from 103.4 kPa to 827.2 kPa. If the initial volume is 80 liters, what is the final volume?
A. 0.001 cu meter
B. 0.10 cu meter
C. 0.01 cu meter
D. 1.01 cu meter

31. Engine pressure ratio is determined by _____.
A. Multiplying engine inlet total pressure by turbine outlet total pressure
B. Dividing engine inlet total pressure by turbine outlet total pressure
C. Multiplying turbine outlet total pressure by engine inlet total pressure
D. Dividing turbine outlet total pressure by engine inlet total pressure

32. What type of oil system is usually found on turbine engines?
A. Dry sump, dip and splash.
B. Dry sump, pressure and spray.
C. Wet sump, pressure and splash.
D. Wet sump, spray and splash.

33. An ideal gas with specific gas constant equal to 395.7 ft-lb/lb-deg R and a ratio of specific heats equal to 1.53, undergoes a reversible constant pressure process during which 465 Btu are added to 4.5 lb of the gas. The initial temperature is 96 deg F. Calculate the change in entropy (in Btu/deg R).
A. 0.63
B. 0.97
C. 0.86
D. 0.79

34. Given the propulsive efficiency, np=2/(1+(Vj/Va)), where Vj= exhaust or jet velocity and Va= free stream-velocity. A propeller produces thrust by means of a large mass flow rate with a small Vj_Va, therefore the np is
A. high
B. low
C. zero
D. constant

35. Liquid propellant rockets have what kind of tanks to store fuel and oxidizer?
A. Green
B. Low pressure
C. High Pressure
D. Insulated

Continued on Page 5

AIRCRAFT POWER PLANT

36. The conditions at the beginning of compression in an Otto engine operating on hot air standard k=1.34, are 101.3 kPa, 0.038 m³ and 32 °C. Clearance is 10% and 12.6 KJ of heat is added per cycle. Determine Pm and cycle efficiency e.
A. 204 kPa, 56%
B. 200 kPa, 90%
C. 300 kPa, 47%
D. 450 kPa, 66%

37. The force that can be produced by an actuating cylinder whose piston has a cross-sectional area of 3 sq. inches operating in a 1000 psi hydraulic system is most nearly
A. 1500 pounds
B. 1000 pounds
C. 500 pounds
D. 3000 pounds

38. A Carnot cycle operates on air as an ideal gas with constant specific heat ratio. At the start of isothermal expansion, it has the following data: 250 lb/sq inch abs, 4 cu ft, and 500 deg F. The ratio of isothermal expansion, V2/V1 = V3/V4 is 3 and the isentropic compression ratio, V4/V1 = V3/V2 is 6. Find the temperature (in deg R) at the end of the isentropical expansion process.
A. 960
B. 940
C. 930
D. 950

39. A cat climbs up a tree and is unable to climb down. The cat weighs 2.5 newtons. Assuming sea level conditions, if the potential energy of the cat with respect to the ground is 12.5 joules, how high is the cat from the ground in feet?
A. 16.4
B. 8.2
C. 9.5
D. 10.5

40. A bowling ball with a mass of 2 kg is thrown with a constant acceleration from rest to 18 km/hr in 3 seconds. Calculate the acceleration (in meters/sec squared)
A. 2.85
B. 1.67
C. 1.28
D. 2.49

41. At what speed must a crankshaft turn if each cylinder of four stoke cycle engine is to be fired 200 times a minute?
A. 800 RPM
B. 200 RPM
C. 400 RPM
D. 1600 RPM

42. Which component of the lubrication system triggers a warning when system pressure drops below a specified level?
A. The pressure switches
B. The bypass filters
C. The pressure transmitter
D. The pressure gage

43. A thermometer reads 521 deg F. What is the reading in deg R?
A. 980.67
B. 449
C. 1,085
D. 745

44. How do you assess the following statements regarding oil cooling in a gas-turbine engine?

A-Fuel may be used to cool oil in gas turbine engines.
B-Ram air may be used to cool oil in gas turbine engines.
A. Both A and B are correct.
B. Only B is correct.
C. Only A is correct.
D. Both A and B are incorrect.

Continued on Page 6

45. Turbojet and turbofan thrust reverser systems are generally powered by
A. fuel pressure, hydraulic pressure, pneumatic pressure
B. fuel presssure, electricity, hydraulic pressure
C. electricity, hydraulic pressure, pneumatic pressure
D. fuel pressure, electricity, pneumatic pressure

46. Turbine blades are generally more susceptible to operating damage than compressor blades because of
A. engineering design problem
B. high pressure and high velocity of gas flow
C. higher centrifugal loading
D. exposure to high temperatures

47. Propeller blade angle is the angle between chord of the blade and the _____.
A. axis of rotation
B. rotational plane of the propeller
C. relative wind
D. angle of attack of the airfoil

48. A turbine operator under steady flow is receiving steam at a speed of 33.3 meters/sec. What is the change in kinetic energy if the steam leaves the turbine at the speed of 100 meters/sec?Express the answer in kJ/kg.
A. 4.446
B. 3.571
C. 7.002
D. 5.306

49. When an engine with a subsonic divergent type inlet duct is running in place at high speed on the ground, the air pressure within the inlet is _____.
A. positive
B. zero
C. ambient
D. negative

50. Which of the following directly affects the rocket engine's thrust?
A. Exhaust temperature
B. Inlet velocity
C. Exit velocity
D. Pressure ratio

*** E N D ***

WARNING: **Failure to submit your Test Questions (Complete) set will cause the cancellation of your Test Results for the subject.**

Seat No.: _____

Republic of the Philippines
PROFESSIONAL REGULATION COMMISSION
Manila

39/50

BOARD OF AERONAUTICAL ENGINEERING

AERONAUTICAL ENGINEERS Licensure Examination
Thursday, November 14, 2019 02:00 p.m. - 05:00 p.m.

ENGINEERING ECONOMICS & MGT., LAWS & ETHICS SET A

INSTRUCTION: Select the correct answer for each of the following questions. Mark only one answer for each item by shading the box corresponding to the letter of your choice on the answer sheet provided. STRICTLY NO ERASURES ALLOWED.

MULTIPLE CHOICE

1. Which will be affected when addition of avionics and associated antenna systems are made forward of the CG limit?
   A. Empty weight and useful load.
   B. Allowable amount of fuel to be loaded to aircraft.
   C. Useful load and maximum gross weight.
   D. CG limit and useful load.

2. The drawings often used in illustrated parts manuals are
   A. Exploded view drawings
   B. Block drawings
   C. Three view drawings
   D. Detail drawings

3. This manual contains the operating limitaion of the aircraft:
   A. Maintenance manual
   B. Flight manual
   C. Wiring diagram manual
   D. Illustrated parts catalogue

4. With respect to maintenance time records, it means the time from the moment an aircraft leaves the surface of the earth until it touches at the next point of landing.
   A. cycle
   B. block time
   C. flight time
   D. time in service

5. An aircraft is considered to be in commuter category under FAR 23 if its weight does not exceed;
   A. 19,500 lbs.
   B. 23,000 lbs.
   C. 10,000 lbs.
   D. 25,000 lbs.

6. The amount of money paid for the airplane by customers
   A. Cost
   B. Investment
   C. Price
   D. Profit

7. For an aircraft design to be viable, one requirement, systems and equipment, should be met. Give an example of this.
   A. Adherence to appropraite design rules
   B. Location of design and manufacturing activities
   C. The control of noise and emissions
   D. Integration of flying and control systems

8. The proper fire-extinguishing agent to use on an aircraft brake fire is _____
   A. water
   B. carbon dioxide
   C. dry powder chemical
   D. foam chemical

Continued on Page 2

9. These are certificates issued as evidence of ownership of a person in a corporation.
   A. Bonds
   B. Certificates of ownership
   C. Share certificates
   D. Stock certificates

10. Aircraft antenna must be grounded to the _____.
   A. bus bar
   B. airframe
   C. wing spar
   D. skin

11. What is the minimum retention period for maintenance records for Part 145 Approved Maintenance Organization (AMO)?
   A. Longer than 3 years.
   B. Up to 2 years from the date the aircraft/component is withdrawn from service.
   C. A minimum of 3 years after the work to which it relates to is done.
   D. A minimum of 5 years after work is done.

12. The quantity of a certain commodity that is offered for sale at a certain price at a given time and place.
   A. Supply
   B. Market
   C. Utility
   D. Demand

13. For airplane with a steerable nose wheel that has a direct mechanical connection to the rudder pedal, the steering mechanism must be designed to withstand the _____ for the maximum pilot forces applied;
   A. steering torque
   B. shimmy load
   C. vertical load
   D. shear forces

14. What refers to the price at which the quantity demanded of a good is exactly equal to the quantity supplied?
   A. Fair market price
   B. Exact market price
   C. Real market price
   D. Equilibrium market price

15. Which of the following changes in the Approved Maintenance Oraganization (AMO) will require an amendment to the AMO certificate?
   A. Change in Accountable Manager
   B. Change of management personnel
   C. Change in release engineers
   D. Change in location

16. The structure must be able to support limit loads without detrimental or
   A. permanent elongation
   B. permanent deformation
   C. partial elongation
   D. temporary deformation

17. The use or authority to use aircraft for the purpose of air navigation.
   A. Authorization
   B. Certification
   C. Maintenance
   D. Operation

18. The annual maintenance cost of a machine shop is P69,994. If the cost of making a forging is P56 per unit and its selling price P135 per forged unit. Find the number of units to be forged to break-even.
   A. 875
   B. 850
   C. 886
   D. 893

19. The quantity of a certain comodity that is bought at a certain price at a given time and place.
   A. Market
   B. Supply
   C. Demand
   D. Utility

Continued on Page 3

20. The scheduled non flight between two airports
A. Tract C. Route
B. Flight segments D. Sector

21. A government bond which have an indefinite life rather than a specific maturity.
A. Coupon C. T-bill
B. Debenture D. Consol

22. What type of manual is a Structural Repair Manual (SRM)?
A. Non-customized manual but not Type-effective
B. Non-customized manual but Type-effective
C. Type manual
D. Customized Manual

23. Which part of aircraft design is the feasibility study?
A. Detail design C. Project design
B. Conceptual design stage D. Manufacture design

24. Airports' pavement type and strength must be designed to be compatible with the landing gear loadings of the aircraft that will use it. Where do the data for the compatibility be found?
A. In the aircraft loading/airport typing system
B. In the aircraft classification number/pavement classification number system
C. In the airport typing system
D. In the aircraft loading system

25. Used with respect to turbo jet engine type certification, it means the maximum thrust that is approved for unrestricted periods of use.
A. Maximum cruise thrust
B. Maximum continuous thrust
C. Maximum take-off thrust
D. Maximum climb thrust

26. Standard torque values are found in Air Transaport Association (ATA) chapter/s
A. 20 only. C. 20 and 30.
B. 20 and 70. D. 50 only.

27. Where would you find the sample of Return to Service Statement in the Civil Air Regulation?
A. Part 2 C. Part 1
B. Part 4 D. Part 6

28. Claims against a person or corporation which must be paid in the near future:
A. Current liability C. Pre-paid income
B. Fixed liability D. Debt

29. The empty weight and corresponding center of gravity must be determined by weighing the airplane with oil and hydraulic fluids;
A. at full capacity C. empty
B. 50% capacity D. 10% capacity

30. The residual value of a company's assets after all outside liabilities (shareholders excluded) have been allowed for
A. Par value C. Dividend
B. Return D. Equity

Continued on Page 4

ENGINEERING ECONOMICS & MGT., LAWS & ETHICS SET A

31. A person may perform maintenance functions for 7 consecutive days.
   A. True, provided he/she is given rest for 24 consecutive hours after his/her duty.
   B. True. provided he/she is given rest for 24 consecutive hours during that 7-day period.
   C. The statement is true.
   D. The statement is false.

32. How long is the validity of a Certificate of Airworthiness?
   A. 3 years
   B. 12 months
   C. Until the loss of airworthiness
   D. Until the certificate is revoked or withrawn

33. It is success in realizing an appropriate income in relation to the investment employed.
   A. Solvency
   B. Financial stability
   C. Insolvency
   D. Profitableness

34. The controllable pitch propeller with constant speed control have
   A. no overspeed limit
   B. manual adjustment
   C. no maximum engine speed limit
   D. a governor

35. Powerplant controls for multi engined aircraft must be located in a protected area at
   A. The left side of the pilot
   B. The center of the cockpit
   C. On the right side of the co-pilot
   D. In a front of the pilot

36. Wich of these regulations establishes the requirements to be met by an organization to qualify for the issuance or continuation of an approval for the maintenance of aircraft and components?
   A. Part 1
   B. Part 145
   C. Part 21
   D. Part 147

37. It denotes the fall in the exchange rate of one currency in terms of others, the term usually applies to floating exchange rates.
   A. Currency depreciation
   B. Currency float
   C. Currency appreciation
   D. Currency devaluation

38. Who is responsible to sign a Return to Service document?
   A. CAAP representative
   B. An aeronautical engineer
   C. Person authorized by AMO
   D. A licensed aircraft mechanic

39. For civil airplane, the minimum controllable speed shall be less than:
   A. 1.4 Vs
   B. 1.2 Vs
   C. 1.5 Vs
   D. 2.0 Vs

40. This classification of cargo compartment is applicable to cargo aircraft only.
   A. Class B
   B. Class D
   C. Class C
   D. Class E

Continued on Page 5

ENGINEERING ECONOMICS & MGT., LAWS & ETHICS SET A

41. The maximum number of hours of flight time a flight crew could be scheduled between required rest periods is;
   A. 10 hours
   B. 8 hours
   C. 6 hours
   D. 12 hours

42. To triple the principal, one must use
   A. Derivatives
   B. Implicit functions
   C. Logarithms
   D. Integration

43. This convention established the liability of carrier for all surface damages done by an aircraft in the another country.
   A. Hague Protocol
   B. Guadalajara Convention
   C. Rome Convention
   D. Warsaw Convention

44. Removable ballast may be installed in FAR 23 certified airplane provided that;
   A. the ballast is removable
   B. the ballast could be relocated
   C. the place for carrying ballast is properly designated and installed
   D. all of these are correct

45. Its objective is to provide means of discussion among the airlines engaged directly or indirectly in international air transportation.
   A. International Airline Pilots Association (IAPA)
   B. International Air Transport Association (IATA)
   C. International Civil Aviation Organization (ICAO)
   D. Internationa; Aviation Administration (IAA)

46. An employee plans to retire in exactly one year and want an account that will pay him P25,000 a year for the next 15 years. Assuming a 6% annual effective interest rate. What is the amount need to deposit now? (The fund will be depleted after 15 years)
   A. P242,608.32
   B. P242,680.22
   C. P242,806.22
   D. P242,860.22

47. A distinct legal entity which can practically transact any business transaction which a real person could do.
   A. Partnership
   B. Sole proprietorship
   C. Corporation
   D. Enterprise

48. Runway configuration is chosen so that they will have manageable crosswind components for _____ operational time for the type of aircraft being used.
   A. a maximum of 50% of
   B. the whole of
   C. a minimum of 75% of
   D. at least 95%

49. The following is the only approved fire extinguishing agent inside the airplane
   A. CO2 and Foam
   B. H2O and Foam
   C. H2O and CO2
   D. methyl bromide and carbon dioxide

50. which organizations are covered by Joint Aviation Requirements (JAR) 145?
   A. Those which maintain only aircraft components.
   B. Those which maintain aircraft or components for commercial air trasportation.
   C. Those which perform only line maintenance on small aircraft.
   D. Those which overhaul only aircraft engines.

*** E N D ***

WARNING: **Failure to submit your Test Questions (Complete) set will cause the cancellation of your Test Results for this subject**