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ENTRANCE EXAMINATION – JULY 2016

QUESTION PAPER

PROGRAMME: Ph. D

AERONAUTICAL ENGINEERING

Time : 2 hours **Marks: 100**

INSTRUCTION TO THE CANDIDATES

1. Use only Pencil to indicate your answers. Use Ball-Point only for writing Name, Register Number and Signature.
2. Darken the square completely. Mark your answers like this 1 **2** 3 4
3. Part A is common to all.

Name of the Student: ..... Programme Applied:	Register Number Exam Centre Seal
Signature of the Student	Signature of the Invigilator

NIUEE 2016

Part A

1. The development of a solid foundation of reliable knowledge typically is built from which type of research?
   a. basic research b. action research
   c. evaluation research d. orientational research

2. The idea that when selecting between two different theories with equal explanatory value, one should select the theory that is the most simple, concise, and succinct is known as _____.
   a. criterion of falsifiability b. critical theory
   c. guide of simplicity d. rule of parsimony

3. Research that is done to examine the findings of someone else using the "same variables but different people" is which of the following?
   a. exploration b. Hypothesis c. Replication d. empiricism

4. A researcher designs an experiment to test how variables interact to influence how well children learn spelling words. In this case, the main purpose of the study was:
   a. Explanation b. Description c. Influence d. Prediction

5. What is the key defining characteristic of experimental research?
   a. extraneous variables are never present
   b. a positive correlation usually exists
   c. a negative correlation usually exists
   d. manipulation of the independent variable

6. Which of the following includes examples of quantitative variables?
   a. age, temperature, income, height
   b. grade point average, anxiety level, reading performance
   c. gender, religion, ethnic group
   d. both a and b

7. One step that is not included in planning a research study is:
   a. Identifying a researchable problem b. A review of current research
   c. Statement of the research question d. Developing a research plan

8. Sources of researchable problems can include:
   a. Researchers' own experiences as educators
   b. Practical issues that require solutions
   c. Theory and past research
   d. All of the above

9. The feasibility of a research study should be considered in light of:
   a. Cost and time required to conduct the study
   b. Skills required of the researcher
   c. Potential ethical concerns
   d. All of the above

10. A formal statement of the research question or "purpose of research study" generally _____.
    a. Is made prior to the literature review b. Is made after the literature review
    c. Will help guide the research process d. b and c

11. Which term refers to publishing several articles from the data collected in one large study?
    a. Duplicate publication
    b. Partial publication
    c. Triplicate publication
    d. None of these

12. Which of the following is a right of each participant according to the AERA?
    a. Deception
    b. Utilitarianism
    c. Freedom to withdraw
    d. Participants have no rights

13. Which of the following is a type of criterion–related validity evidence?
    a. Concurrent evidence
    b. Predictive evidence
    c. Internal consistency
    d. Both a and b are correct answers

14. Which of the following is not a type of reliability?
    a. Test-retest b. Split-half c. Content d. Internal consistency

15. Which of the following types of reliability refers to the consistency of test scores over time?
    a. Equivalent forms reliability
    b. Split-half reliability
    c. Test-retest reliability
    d. Inter-scorer reliability

16. Which type of reliability refers to the consistency of a group of individuals' scores on two equivalent forms of a test designed to measure the same characteristic?
    a. Split-half b. Test-retest c. Split-forms d. Equivalent forms

17. _____ refers to how well the particular sample of behaviors used to measure a characteristic reflects the entire domain of behaviors that constitutes that characteristic.
    a. Construct validity evidence
    b. Criterion-related validity evidence
    c. Content validity evidence
    d. Face validity evidence

18. Which of these is not a method of data collection.
    a. Questionnaires b. Interviews c. Experiments d. Observations

19. Another name for a Likert Scale is a(n):
    a. Interview protocol
    b. Event sampling
    c. Summated rating scale
    d. Ranking

20. A question during an interview such as “Why do you feel that way?” is known as a:
    a. Probe b. Filter question c. Response d. Pilot

21. A census taker often collects data through which of the following?
    a. Standardized tests
    b. Interviews
    c. Secondary data
    d. Observations

22. In which of the following nonrandom sampling techniques does the researcher ask the research participants to identify other potential research participants?
    a. Snowball b. Convenience c. Purposive d. Quota

23. Which of the following is the most efficient random sampling technique?
    a. Simple random sampling
    b. Proportional stratified sampling
    c. Cluster random sampling
    d. Systematic sampling

24. Which of the following would usually require the smallest sample size because of its efficiency?
    a. One stage cluster sampling b. Simple random sampling
    c. Two stage cluster sampling d. Quota sampling

25. _____ is a set of elements taken from a larger population according to certain rules.
    a. Sample b. Population c. Statistic d. Element

Part B

26. An Euler-Bernoulli beam in bending is assumed to satisfy
    a. both plane stress as well as plane strain conditions
    b. plane strain condition but not plane stress condition
    c. plane stress condition but not plane strain condition
    d. neither plane strain condition nor plane stress condition

27. A statically indeterminate frame structure has
    a. Same number of joint degrees of freedom as the number of equilibrium equations
    b. Number of joint degrees of freedom greater than the number of equilibrium equations
    c. Number of joint degrees of freedom less than the number of equilibrium equations
    d. Unknown number of joint degrees of freedom, which cannot be solved using laws of Mechanics

28. An impulsive launch of a rocket minimizes the loss of burn-out velocity due to
    a. Aerodynamic drag force only b. Gravitational force only
    c. Both aerodynamic drag and gravitational forces d. Reaction jet control force

29. Multi-staging in rockets improves the burn-out performance by increasing mainly stage-wise
    a. payload mass ratios b. structural mass efficiencies
    c. propellant masses d. control system masses

30. Lift on an aircraft climbing vertically up is
    a. equal to its weight b. zero c. equal to the drag d. equal to the thrust

31. If an aircraft is performing a positive yawing maneuver, the side slip angle
    a. is always zero b. is never zero c. is always negative d. could be any value

32. For an airplane to be statically stable, its centre of gravity must always be
    a. ahead of wing aerodynamic centre b. aft of the wing aerodynamic centre
    c. ahead of neutral point d. aft of neutral point

33. It is seen that the drag polar of a certain aerofoil is symmetric about the Cd axis. This drag polar could refer to
    a. NACA 0012 b. NACA 4415 c. NACA 23012 d. None of the above

34. The aerodynamic centre of a supersonic aerofoil, with chord c, is located at
    a. the leading edge b. 0.25c c. 0.5c d. 0.75c

35. A main objective of by-pass in a turbo-fan engine is to increase
    a. mass flow rate through engine inlet b. turbine inlet temperature
    c. mass flow rate through exhaust nozzle d. compressor pressure ratio

36. Materials which can store electrical energy are called
    a. magnetic materials. b. semi conductors.
    c. dielectric materials. d. super conductors

37. Property of material which allows it to be drawn out into wires is
    a. Ductility b. Solder ability c. Super conductivity d. Malleability

38. Brass is an alloy of
    a. copper and zinc b. copper and iron
    c. copper and Aluminium d. copper and tin

39. In n type semi conductor added impurity is
    a. pentavalent b. divalent c. tetravalent d. trivalent

40. Propulsion efficiency of a jet engine is
    a. directly proportional to both the thrust power and the air mass flow rate
    b. inversely proportional to both the thrust power and the air mass flow rate
    c. directly proportional to the thrust power and inversely proportional to the air mass Flow rate
    d. Inversely proportional to the thrust power and directly proportional to the air mass flow rate

41. Dielectric materials are
    a. Insulating materials. b. Semiconducting materials.
    c. Magnetic materials. d. Ferroelectric materials.

42. The pressure ratio in any one stage of a jet engine compressor is limited by
    a. entry stagnation temperature in that stage
    b. entry Mach number in that stage
    c. pressure gradient induced separation in that stage
    d. mass flow rate in that stage

43. The material with lowest resistivity is
    a. constantan. b. silver. c. manganin. d. nichrome.

44. Bronze is an alloy of
    a. copper. b. aluminium. c. silver. d. carbon.

45. Thermodynamic cycle on which the jet engine operates can be
    a. open Rankine cycle only b. either open or closed Rankine cycle
    c. open Brayton cycle only d. either open or closed Brayton cycle

46. Ceramics are good
    a. insulators. b. conductors. c. superconductors. d. semiconductors.

47. Permanent magnets are made of
    a. soft magnetic materials. b. hard magnetic materials.
    c. semi conductors. d. super conductors.

48. Copper is completely miscible with
    a. nickel. b. gold. c. hydrogen. d. lead.

49. Winglets are used on wings to minimize
    a. skin friction drag b. profile drag

c. wave drag d. induced drag

50. An aircraft in trimmed condition has zero pitching moment at
a. its aerodynamic centre. b. its centre of gravity.
c. 25% of its mean aerodynamic chord. d. 50% of its wing root chord

51. In an aircraft, constant roll rate can be produced using ailerons by applying
a. a step input. b. a ramp input. c. a sinusoidal input. d. an impulse input.

52. For a symmetric airfoil, the lift coefficient for zero degree angle of attack is
a. – 1.0 b. 0.0 c. 0.5 d. 1.0

53. The critical Mach number of an airfoil is attained when
a. the freestream Mach number is sonic.
b. the freestream Mach number is supersonic.
c. the Mach number somewhere on the airfoil is unity.
d. the Mach number everywhere on the airfoil is supersonic

54. The shadowgraph flow visualization technique depends on
a. the variation of the value of density in the flow.
b. the first derivative of density with respect to spatial coordinate.
c. the second derivative of density with respect to spatial coordinate.
d. the third derivative of density with respect to spatial coordinate

55. The Hohmann ellipse used as earth-Mars transfer orbit has
a. apogee at earth and perigee at Mars. b. both apogee and perigee at earth.
c. apogee at Mars and perigee at earth. d. both apogee and perigee at Mars

56. The governing equation for the static transverse deflection of a beam under an uniformly distributed load, according to Euler-Bernoulli (engineering) beam theory, is a
a. 2nd order linear homogenous partial differential equation.
b. 4th order linear non-homogenous ordinary differential equation.
c. 2nd order linear non-homogenous ordinary differential equation.
d. 4th order nonlinear homogenous ordinary differential equation.

57. The Poisson's ratio, vof most aircraft grade metallic alloys has values in the range:
a. $-1\ \nu \leq \leq 0$ b. $0\ \nu \leq \leq 0.2$ c. $0.2\ \nu \leq \leq 0.4$ d. $0.4\ \nu \leq \leq 0.5$

58. During the ground roll maneuver of an aircraft, the force(s) acting on it parallel to the direction of motion
a. is thrust alone. b. is drag alone.
c. are both thrust and drag. d. are thrust, drag and a part of both weight and lift.

59. An aircraft in a steady climb suddenly experiences a 10% drop in thrust. After a new equilibrium is reached at the same speed, the new rate of climb is
a. lower by exactly 10%. b. lower by more than 10%.
c. lower by less than 10%. d. an unpredictable quantity

60. In an aircraft, the dive maneuver can be initiated by
a. reducing the engine thrust alone. b. reducing the angle of attack alone.
c. generating a nose down pitch rate. d. increasing the engine thrust alone.

61. In an aircraft, elevator control effectiveness determines
a. turn radius. b. rate of climb.

c. forward-most location of the centre of gravity. d. aft-most location of the centre of gravity.

62. Bernoulli's equation is valid under steady state
    a. only along a streamline in inviscid flow, and between any two points in potential flow.
    b. between any two points in both inviscid flow and potential flow.
    c. between any two points in inviscid flow, and only along a streamline in potential flow.
    d. only along a streamline in both inviscid flow and potential flow.

63. The ratio of flight speed to the exhaust velocity for maximum propulsion efficiency is
    a. 0.0 b. 0.5 c. 1.0 d. 2.0

64. The ideal static pressure coefficient of a diffuser with an area ratio of 2.0 is
    a. 0.25 b. 0.50 c. 0.75 d. 1.0

65. A rocket is to be launched from the bottom of a very deep crater on Mars for earth return. The specific impulse of the rocket, measured in seconds, is to be normalized by the acceleration due to gravity at
    a. the bottom of the crater on Mars. b. Mars standard "sea level".
    c. earth's standard sea level. d. the same depth of the crater on earth.

66. Which one of the following is supersonic aerofoil?
    a. Symmetrical aerofoil b. Cambered aerofoil
    c. Unsymmetrical aerofoil d. Biconvex aerofoil

67. Flow around the rotating cylinder is called by the name:
    a. Magnus effect b. Spinning effect
    c. Circulation effect d. Stream line effect

68. Critical mach number is defined as the free stream mach number at any point on the aerofoil became:
    a. Subsonic b. Supersonic c. Sonic d. Hypersonic

69. A complete airplane having how many degrees of freedom?
    a. One degree of freedom b. Two degree of freedom
    c. Three degree of freedom d. Six degree of freedom

70. Ailerons are used for one the following stability and control?
    a. Longitudinal stability and control b. Lateral stability and control
    c. Directional stability and control d. dynamic stability and control

71. For a steady level flight which one of the following is true?
    a. Lift = Weight ; Thrust = Drag b. Lift = Drag ; Thrust = Weight
    c. Steady flow = Unsteady flow d. Profile drag = Induced Drag

72. Which one of the following is high lift device?
    a. Rudder b. Elevator c. Aileron d. Leading edge slot

73. Induced drag is otherwise known as:
    a. Trailing vortex drag b. Wave drag
    c. Surface friction Drag d. Form drag

74. Aerodynamic centre is defined as the point about which;
a. Pitching moment co- efficient in constant b. Pitching moment co-efficient is zero
c. Lift = 0 d. Lift = constant

75. Which of the following statement concerning fatigue is not true?
a. Fatigue is still a very important design criterion in the aircraft industry.
b. Flying at high altitude contributes to the same extent to fatigue of aircraft parts as flying at low altitude.
c. All aircraft parts encounter different fatigue loads.
d. It is better to express the life of the aircraft in flights rather than in flying hours.

76. The stressed skin principle is often applied in the aircraft wing. Yet, also integral parts can be used for the wing. When applying integral parts (one answer)
a. Riveting is not necessary resulting in a more smooth surface,
b. Inspection will be more difficult,
c. More maintenance will be necessary d. This results in a heavier structure.

77. Large cutouts like doors and hatches are applied in the fuselage of large transport aircraft. The designer has to pay extra attention to these cutouts. Why is this important (one answer)?
a. The cutouts disturb the perfect shell structure.
b. The location and installation of the opening and locking mechanism often gives problems.
c. Loading and unloading of the aircraft often leads to damage of the structure around doors and hatches.
d. The edges of the cutouts have to be reinforced.

78. Which one of the following statement is not true?
a. Bending of a symmetric section subject to a skew load will be un-symmetric.
b. In unsymmetrical bending, the neutral axis passes through the centroid of the cross section.
c. A beam bends about its neutral axis for both symmetrical and unsymmetrical bending.
d. In unsymmetrical bending, bending takes place in a plane is same as that of the plane of principal axis.

79. Beam is defined as
a. A vertical pillar used to support a compressive load.
b. A structural component designed to resist longitudinal compression.
c. A bar which is loaded transversely.
d. It is composed of several bars or rods jointed together in a particular fashion.

80. Limit load in aircraft is defined as
a. The load at which permanent deformation of the aircraft is expected to experience in normal operation.
b. The load that probably occurs once in the life of the aircraft at which no permanent deformation is allowed
c. The load that will occur once in the life an aircraft at which the chance on permanent deformation is not present.
d. The load which is the maximum that the aircraft is expected to experience in normal operation.

81. Buckling denotes that,
a. Consider this change in thin section.
b. No change in cross sectional area while the wave length of the buckle is of the

same order as the length of the element.
c. Compression members tend to fail as a result of the lateral bending induced by the compression load.
d. Changes in cross-sectional area occur and the wave length of the buckle is of the order of the cross-sectional dimensions of the element.

82. According to maximum principal stress theory the failure of the material is assumed to take place when
a. The value of the maximum principal strain (e_1) reaches a value to that of the elastic limit strain (fy /E)of the material.
b. The max. shear stress τ_{max} in the complex system reaches the value of the shear stress in simple tension at the elastic limit.
c. The maximum shear strain exceeds the shear strain determined from the simple tensile test.
d. The value of the maximum principal stress (σ_1) reaches a value to that of the elastic limit stress (fs) of the material $\sigma_1 = fy$.

83. Failure theories applicable to brittle material is
a. Maximum principal stress theory and Octahedral shear stress theory.
b. Maximum principal stress theory and Maximum principal strain theory.
c. Maximum shear stress theory and Maximum shear strain theory.
d. Maximum shear strain theory and Maximum strain energy theory.

84. Which one is false statement?
a. To carry a given load, a monocoque structure is heavier than semi-monocoque construction.
b. The aerodynamic force produced by air flow over an aerofoil surface is called drag.
c. The formers and bulkheads provide shape for fuselage.
d. The spars are the principal structural members of the wing.

85. Fighter bombers use following type of engine
a. Turbo jet b. Turbo Prop c. Rocket d. Ramjet

86. Air-Fuel Ratio in a jet engine will be of the order of
a. 10:1 b. 15:1 c. 20:1 d. 60:1

87. In which case the air-fuel ratio is likely to be maximum
a. 2 stroke engine b. 4 stroke petrol engine
c. 4 Stroke diesel engine d. gas turbine

88. In free convection heat transfer, Nusselt number is a function of
a. Grashoff no and Reynold no b. Grashoff no and Prandtl no
c. Prandtl and Reynolds d. none

89. Stefan Boltzman law is applicable for heat transfer by
a. Conduction b. Convection
c. Radiation d. conduction and radiation combined

90. Principle of Jet propulsion is based on
a. Newton's 2^{nd} law of motion b. Newton's 3^{rd} law of motion
c. 1^{st} law of thermodynamics d. 2^{nd} law of thermodynamics

91. What type of energy conversion takes place in rocket propulsion?
a. Heat energy to mechanical energy b. Chemical energy to mechanical energy

c. Chemical energy to heat energy d. Mechanical energy to heat energy

92. Which nation developed the biggest solid propellant rocket
a. INDIA b. ESA(Europe) c. USA d. RUSSIA

93. Which nation has the biggest operated Cryogenic booster?
a. USA b. RUSSIA c. ESA (Europe) d. JAPAN

94. Which rocket propellant combination has the maximum specific impulse
a. Solid composite propellant b. Cryogenic (LOX-LH_2)propellants
c. Storage liquid propellants d. Semi-cryogenic propellant (LOX-UDMH)

95. What type of cooling system is adopted in thrust chamber of long duration Cryogenic booster engine?
a. Ablative cooling b. Film cooling
c. Regenerative cooling d. Sweat cooling

96. What is the range of maximum specific impulse achievable in advanced propulsion systems?
a. 300-500 (Secs) b. 1000-1500(Secs) c. 1500-20000(Secs) d. 2000-5000(secs)

97. What is the most effective thrust vector control (TVC) system adopted in Solid boosters?
a. Jet vane type b. Secondary injection TVC
c. Gimbal actuators d. Secondary /Vernier engines

98. In Air breathing engines supersonic combustor is used at what flight Mach number?
a. 1.5 to 4 b. Above 5 c. 1.5 to 2 d. Below 1

99. In aircraft gas turbines, which type of blading is most efficient?
a. Impulse blading b. Reaction blading
c. Impulse –reaction blading d. None of the above.

100. Lift produced by the rotating cylinder is known as:
a. vortex effect b. magnus effect c. rotational effect d. lifting effect