ENTRANCE EXAMINATION FOR ADMISSION, MAY 2013.

Ph.D. (MECHANICAL ENGINEERING)

COURSE CODE : 139

Register Number : [ ]

Signature of the Invigilator
(with date)

COURSE CODE : 139

Time : 2 Hours Max : 400 Marks

Instructions to Candidates :

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.
2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.
3. Read each of the question carefully and shade the relevant answer (A) or (B) or (C) or (D) in the relevant box of the ANSWER SHEET using HB pencil.
4. Avoid blind guessing. A wrong answer will fetch you –1 mark and the correct answer will fetch 4 marks.
5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.
6. Do not open the question paper until the start signal is given.
7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.
8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.
9. Use of Calculators, Tables, etc. are prohibited.

1. A non dimensional number generally associated with natural convection heat transfer is

(A) Grashoff number
(B) Nusselt number
(C) Weber number
(D) Prantdl number

2. Thermal conductivity of solid metals with rise in temperature normally

(A) increases
(B) decreases
(C) remains constant
(D) may increase or decrease depending on temperature

3. Which of the following has least value of conductivity

(A) glass
(B) water
(C) rubber
(D) air

4. Emissivity of a white polished in comparison to black body is

(A) higher
(B) lower
(C) same
(D) depending on the shape of the body

5. If the temperature of a solid surface changes from 27 °C to 627 °C, then the emissive changes in the ratio of

(A) 3
(B) 9
(C) 27
(D) 81

6. Long mean temperature difference in case of counter flow compared to parallel flow will be

(A) same
(B) more
(C) less
(D) none of the above

7. Delta iron occurs at a temperature of

(A) room temperature
(B) above melting point
(C) between 1400 °C and 1539 °C
(D) between 910 °C and 1400 °C

8. Process of austempering results in

(A) formation of bainite structure

(B) carburised structure

(C) martenistic structure

(D) relieving of stress throught the component

9. Melting point of iron is

(A) 1530 °C (B) 1601 °C

(C) 1712 °C (D) 1131 °C

10. Acidic solution is one which has pH value

(A) greater than 7 (B) less than 7

(C) equal to 7 (D) none of the above

11. Ferromagnetic alpha iron exists in temperature range of

(A) below 723 °C (B) 770-910 °C

(C) 1400 – 1539 °C (D) above 1539 °C

12. Balls for ball bearing are made of

(A) mild steel (B) cast iron

(C) carbon-chrome steel (D) high carbon steel

13. Corrosion resistance of steel is increased by adding

(A) chromium and nickel (B) aluminium and zinc

(C) tungsten and sulphur (D) nickel and molybdenum

14. Age – hardening is related with

(A) stainless steel (B) gun metal

(C) duralumin (D) cast iron

15. A fluid is said to be ideal, if it is

(A) incompressible (B) inviscous

(C) viscous and incompressible (D) inviscous and incompressible

16. For pipes, laminar flow occurs when Reynolds number is

(A) less than 2000 (B) between 2000 and 4000

(C) more than 4000 (D) less than 4000

17. Corrosion of iron is retarded by

(A) the presence of salts

(B) low pH conditions

(C) high pH conditions

(D) both the presence of salts and high pH conditions

18. Routing in production planning and control refers to

(A) sequence of operations to be performed

(B) balancing of load on machines

(C) authorization of work to be performed

(D) progress of operation to be performed

19. Economic order quantity is the quantity at which the cost of carrying is

(A) minimum (B) cost of overstocking

(C) less than the cost of ordering (D) equal to the cost of ordering

20. Potentiometer sensors are used to measure

(A) temperature (B) pressure

(C) displacement (D) liquid level

21. In electro chemical machining the metal is removed by

(A) Dissolution (B) evaporation

(C) sputtering (D) shearing

22. The sintered properties in powder metallurgy depend upon

(A) porosity (B) volume

(C) density (D) all the above

23. Which moulding process is preferable for large and heavy casting?

(A) Green sand moulding (B) Skin dried moulding

(C) Pit moulding (D) Shell moulding

24. The operation of milling two sides of a work piece simultaneously is called

(A) Gang milling (B) Climb milling

(C) Square milling (D) Straddle milling

25. Value of coefficient of friction in cold forming

(A) 0.5 (B) 0.2 (C) 0.1 (D) 0.6

26. The size of shaper is specified by

(A) Length of stroke (B) Height of table

(C) Maximum size of tool (D) Ratio of forward to return stroke

27. Eden – Rolt comparator is a popular instrument for calibration of

(A) slip gauges (B) vernier

(C) micrometer (D) sine bar

28. The helix angle for single helical gears range from

(A) 5° to 10° (B) 10° to 15°

(C) 20° to 35° (D) 50° to 60°

29. Which one of the following is not a direct surface roughness measuring instrument?

(A) Tomlinson surface meter (B) Taylor – Hobson Taysurf

(C) Wallace surface dynamometer (D) Profilometer

30. Greater flexibility in the context of work distribution to machines and workers is achieved in

(A) process layout (B) cellular layout

(C) mixed layout (D) fixed position layout

31. Micromachining is the basic technology for fabrication of micro-components of size in the range of

(A) 1 to 500 micrometers (B) 600 to 700 micrometers

(C) 750 to 900 micrometers (D) 850 to 950 micrometers

32. Segmental chips are formed during machining

(A) cast iron (B) mild steel

(C) high speed steel (D) high carbon steel

33. Drilling is an example of

(A) orthogonal cutting (B) oblique cutting

(C) simple cutting (D) uniform cutting

34. The work or surface speed for cylindrical grinding varies from

(A) 5 to 10 m/min (B) 10 to 20 m/min

(C) 20 to 30 m/min (D) 40 to 60 m/min

35. Strain energy is the

(A) energy stored in a body when strained within elastic limits

(B) energy stored in a body when strained upto the breaking of a specimen

(C) maximum strain energy which can be stored in a body

(D) proof resilience per unit volume of a material

36. The equation for relationship between E,G and K is

(A) $E = \frac{3KG}{K+9G}$ (B) $E = \frac{3KG}{9K+G}$

(C) $E = \frac{9KG}{K+3G}$ (D) $E = \frac{9KG}{3K+G}$

37. A pipe of diameter 800 mm contains fluid under a pressure of $2N/mm^2$. If the tensile strength is $100N/mm^2$, the thickness of the pipe is

(A) 16 mm (B) 4 mm (C) 8 mm (D) 10 mm

38. Beams with four unknown reaction is

(A) In – Determinate Beams (B) Determinate Beams

(C) Propped beams (D) Im-Propped beams

39. The ultimate tensile stress is the ratio of

(A) Maximum area and load (B) Maximum load and area

(C) Maximum stress and strain (D) None of the above

40. Carriage springs are also known as

(A) Open coiled spring (B) Closely coiled spring

(C) Semi-elliptical type leaf spring (D) Fully-elliptical type leaf spring

41. Euler's formula holds good only for

(A) short columns (B) long columns

(C) both short and long columns (D) weak columns

42. A steel bar of 5 mm is heated from 15° C to 40° C and it is free to expand. The bar will induce

(A) no stress (B) shear stress

(C) tensile stress (D) compressive stress

43. In the torsion equation $\frac{T}{J} = \frac{\tau}{R} = \frac{C\theta}{l}$ the term J/R is called

(A) Shear modulus (B) Section modulus

(C) Polar modulus (D) None of the above

44. The point of contraflexure is a point where

(A) shear force changes sign (B) bending moment changes sign

(C) shear force is maximum (D) bending moment is maximum

45. If the tearing efficiency of a riveted joint is 50%, then ratio of rivet hole diameter to the pitch of rivets is

(A) 0.2 (B) 0.3

(C) 0.5 (D) 0.6

46. When a body is subjected to a direct tensile stress (σ_x) in one plane accompanied by a simple shear stress (τ_{xy}), the minimum normal stress is

(A) $\frac{\sigma_x}{2} + \frac{1}{2}\sqrt{\sigma_x^2 + 4\tau_{xy}^2}$ (B) $\frac{\sigma_x}{2} - \frac{1}{2}\sqrt{\sigma_x^2 + 4\tau_{xy}^2}$

(C) $\frac{\sigma_x}{2} + \frac{1}{2}\sqrt{\sigma_x^2 - 4\tau_{xy}^2}$ (D) $\frac{1}{2}\sqrt{\sigma_x^2 + 4\tau_{xy}^2}$

47. If the resultant of two equal forces has the same magnitude as either of the forces, then the angle between the two forces is

(A) 30° (B) 60°

(C) 90° (D) 120°

48. The unit of angular acceleration is

(A) N-m (B) m/s

(C) m/s^2 (D) rad/s^2

49. The force required to move the body up the plane will be minimum if it makes an angle with the inclined plane _____ the angle of friction.

(A) Equal to (B) Less than

(C) Greater than (D) None of the above

50. When the spring of a watch is wound, it will possess

(A) Strain energy (B) Kinetic energy

(C) Heat energy (D) Electrical energy

51. One joule is equal to

(A) 0.1 N-m (B) 1 N-m (C) 10 N-m (D) 100 N-m

52. Non-coplaner non-concurrent forces are those forces which

(A) meet at one point, but their lines of action do not lie on the same plane

(B) do not meet at one point and their lines of action do not lie on the same plane

(C) do not meet at one point but their lines of action lie on the same plane

(D) none of the above

53. Soderberg relation is based on _____ of the material whereas all other failure relation for dynamic loading are based on ultimate strength of the material

(A) elastic strength (B) yield strength

(C) shear strength (D) none of the above

54. The total frictional torque for a thrust bearing is given by _____ Where μ is the coefficient of friction, W load transmitted, R – outer radius of collar and r – inner radius of the collar

(A) $\frac{1}{3}\mu W\left[\frac{R^3-r^3}{R^2-r^2}\right]$ (B) $\mu W\left[\frac{R^3-r^3}{R^2-r^2}\right]$

(C) $2\mu W\left[\frac{R^3-r^3}{R^2-r^2}\right]$ (D) $\frac{2}{3}\mu W\left[\frac{R^3-r^3}{R^2-r^2}\right]$

55. For maximum power, the velocity of the belt will be

(A) $\sqrt{\frac{T}{m}}$ (B) $\sqrt{\frac{T}{2m}}$ (C) $\sqrt{\frac{T}{3m}}$ (D) $\sqrt{\frac{T}{12m}}$

56. Which of the following statement is correct for gears?

(A) The addendum is less than dedendum

(B) The pitch circle diameter is equal to the product of module and number of teeth

(C) The pitch circle is always greater than the base circle

(D) all of the above

57. Allen bolts are

(A) Self locking bolts

(B) Provided with hexagonal depression in head

(C) Uniform strength bolts

(D) Designed for shock load

58. The product of the diametral pitch and circular pitch is equal to

(A) 1 (B) 1/n (C) n (D) 2n

59. The groove angle of the pulley for rope drive is usually

(A) 45° (B) 30° (C) 20° (D) 60°

60. The working fluid in refrigeration cycle is

(A) refrigerator (B) refrigerant (C) absorbent (D) lubricant

61. The taper on a rectangular sunk key is

(A) 1 in 16 (B) 1 in 32 (C) 1 in 48 (D) 1 in 100

62. A type of brake commonly used in motor cars is a

(A) shoe brake (B) band and block brake

(C) band brake (D) internal expanding brake

63. The processes occurring in open system which permit the transfer of mass to and from the system, are known as

(A) flow processes (B) non-flow processes

(C) adiabatic processes (D) isothermal processes

64. The compression ratio for petrol engines is

(A) 4 to 6 (B) 5 to 8

(C) 18 to 22 (D) 25 to 30

65. The ratio of heat flow $\frac{Q_1}{Q_2}$ from two walls of same thickness having their thermal conductivities $K_1 = 2K_2$ will be

(A) 2 (B) 1

(C) 0.3 (D) 0.5

66. Morse test is used to test the performance of

(A) Two stroke engines (B) Four stroke engines

(C) Multi cylinder engines (D) Single cylinder engine

67. The brake power of an engine whose mechanical efficiency is 80% and indicated power is 125000 W as

(A) 10 kW (B) 10000 kW (C) 100 kW (D) 150 kW

68. Efficiency of Diesel cycle depends on

(A) Compression ratio

(B) Cut off ratio

(C) Compression ratio and cut off ratio

(D) Cut off and pressure ratio

69. A certain gas has C_p value of 1968 J/kg K and C_v value of 1507 J/kg K. The value of R is

(A) 0.461 KJ/kg K (B) 1307 J/kg K

(C) 1 (D) 461 KJ/kg K

70. Frost on cooling coils

(A) Increases heat transfer

(B) Improves COP of the system

(C) Reduces power consumption

(D) Acts as insulation, increasing power consumption

71. A intensive property of a system is one whose value

(A) Depends on the mass of the system, like volume

(B) Does not depends on the mass of the system, like temperature, pressure etc.,

(C) Is not dependent on the path followed but on the state

(D) is dependent on the path followed and not on the state

72. Moderator in nuclear plants is used to

(A) Reduce temperature

(B) Extract heat from nuclear reaction

(C) Control the reaction

(D) Cause collision with the fast moving neutrons to reduce their speed

73. Super heating of steam is done at

(A) Constant volume (B) Constant pressure

(C) Constant temperature (D) Constant enthalpy

74. On mollier chart, free expansion or throttling process from high pressure to atmosphere is represented by

(A) Horizontal straight line (B) Vertical straight line

(C) Curved line (D) None of the above

75. A compressor at high altitude will draw

(A) More power (B) Less power

(C) Same (D) Dependent on the other factors

76. The workdone factor for an axial compressor varies from

(A) 0.5 to 0.75 (B) 0.6 to 0.8

(C) 0.82 to 0.73 (D) 0.98 to 0.85

77. Laminar flow changes to Turbulent flow when

(A) Diameter of pipe is decreased

(B) Velocity is increased

(C) Viscosity of fluid is increased

(D) Velocity is decreased

85. The discharge through a single acting reciprocating pump is

(A) $Q = \frac{ALN}{60}$ (B) $Q = \frac{2\,ALN}{60}$

(C) $Q = ALN$ (D) $Q = 2ALN$

86. The tangential velocity of ideal fluid at any point on the surface of the cylinder is given by

(A) $u_\theta = \frac{1}{2} U \sin\theta$ (B) $u_\theta = U \sin\theta$

(C) $u_\theta = \frac{1}{2} U \cos\theta$ (D) None of the above

87. The boundary layer separation takes place if

(A) Pressure gradient is zero (B) Pressure gradient is +ve

(C) Pressure gradient is negative (D) None of the above

88. Sonic flow means

(A) Mach number < 1.0 (B) Mach number > 1.0

(C) Mach number = 1.0 (D) None of the above

89. One nm is equal to

(A) 10^{-3} (B) 10^{-9} (C) 10^{-6} (D) 10^{-10}

90. Difficult to monitor and very dangerous form of corrosion

(A) Galvanic (B) Pitting (C) Crevice (D) Stress

91. Corrosion of metals involves

(A) Physical reactions (B) Chemical reactions

(C) Both (D) None of the above

92. The following factors play vital role in corrosion process

(A) Temperature (B) Solute concentration

(C) Both (D) None of the above

93. Rectilinear motion of piston is converted in to rotary by

(A) Cross head
(B) Slider crank
(C) Connecting rod
(D) Gudgeon pin

94. A kinematic chain requires at least

(A) 2 links and 3 turning pairs
(B) 3 links and 4 turning pairs
(C) 4 links and 4 turning pairs
(D) 5 links and 4 turning pairs

95. Bernoulli's theorem deals with the law of conservation of

(A) Mass
(B) Momentum
(C) Energy
(D) None of the above

96. Which of the following forms of pure carbon is known as Buckyball?

(A) Fullerene
(B) Diamond
(C) Graphite
(D) None of the above

97. In EDM, the material of the tool is

(A) Diamond
(B) High speed steel
(C) Copper
(D) Tungsten carbide

98. The machining process which needs vacuum for its operation is

(A) Electron beam machining
(B) Electrical discharge machining
(C) Electro chemical machining
(D) Plasma machining

99. Which of the following statement is correct about EDM machining?

(A) It can machine hardest materials
(B) It produces high degree of surface finish
(C) The tool and work are never in contact with each other
(D) all of these

100. The heat treatment process used for softening hardened steel is

(A) Carburising
(B) Normalising
(C) Annealing
(D) Tempering