Punjab Technical University

Maximum Marks: 90 **Time: 90Mins.**

Entrance Test for Enrollment in Ph.D Programme

Important Instructions

- **Fill all the information in various columns, in Capital letters, with blue/black point pen for attempting the questions**
- **Use of calculators is not allowed.**
- **Make attempt by writing the answer in capital Letters in the box against each question number.**
- **All questions are compulsory. Each Question has only one right answer. No Negative marking for wrong answers.**
- **Questions attempted with two or more options/answers will not be evaluated.**

Stream: **……Engineering ……..**

Discipline **……Civil Engineering……..**

Name **……..**

Fathers Name **……..**

Roll Number **Date: 13-07-2014**

Signature of Candidate: **……..**

Signature of Invigilator **……..**

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1. If A and B are non-zero square matrices of the same order such that AB = 0, then
   a) Adj A = 0 or adj B = 0
   b) Adj A =0 or adj B = 0
   c) |A|= 0 or |B|= 0
   d) |A|= 0 or |B|= 0

2. If

   $A = \begin{bmatrix} 2x & 0 \\ x & x \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1 & 0 \\ -1 & 2 \end{bmatrix}$

   Then the value of x is
   a) 1
   b) 2
   c) 1/2
   d) None of the above

3. If the rank of a matrix A is 2, then the rank of 2A is
    a) 1
    b) 2
    c) 4
    d) None of the above.
4. If 1 and 2 are the eigen values of a 2-rowed square matrix A and I_2 is the unit matrix of order 2, there A^3 is equal to
    a) $6A + I_2$
    b) $6A - I_2$
    c) $7A + 6 I_2$
    d) $7A - 6 I_2$

5. The function f(x) is integrable over[a, b] if
    a) f(x)is derivable in (a, b)
    b) f(x)is derivable in [a, b]
    c) f(x) is continuous in [a, b]
    d) f(x) is continuous in [a, b]
    e) none

6. Minimum value of the function $x^2 – x$ is
    a) 1/4
    b) -1/4
    c) 0
    d) None of the these
7. The maximum value of $\frac{\log x}{x}$ is
    a) e
    b) 0
    c) 1/e
    d) None

8. $4\frac{d^2y}{dx^2} - 6\frac{dy}{dx} = 4x$ is a …… Differential equation.
    a) Linear
    b) Second linear
    c) Homogeneous
    d) Only(a) and (b) are correct

9. A differential equation in which the dependent variable and its derivatives occur only in first degree and are not multiplied together is called a . . . . . differential equation
    a) Homogeneous
    b) Linear
    c) Linear (with constant coefficients)
    d) Non – homogeneous

10. The position of centre of pressure of plane surface immersed in a static fluid is
    a) at the centroid of the submerged surface
    b) always above centroid
    c) always below centroid
    d) none of the above options

11. The total pressure on a plane surface of area 'A' inclined at an angle θ with the horizontal is equal to
    a) pA
    b) pA sin θ
    c) pA cos θ
    d) pA tan θ

12. Centre of buoyancy always
    a) Coincides with the centroid of the fluid volume displaced.
    b) Coincides with centre of gravity of the body
    c) Remains above centre of gravity
    d) Remains below centre of gravity

13. A floating body is in a state of stable equilibrium.
    a) When its metacentre is below its centre of gravity
    b) When its metacentre is below its centre of buoyancy
    c) When the metacentre is above centre of gravity
    d) When metacentre height of a ship.

14. Pascal's Law relates that pressure at a point is equal in all directions in a
    a) Liquid at rest
    b) Fluid at rest
    c) Laminar flow
    d) Turbulent flow

15. The pressure drag depends upon
    a) The boundary layer formation
    b) The separation of boundary layer
    c) Size of the wake
    d) None of the above

16. Drag force is a function of
    a) Velocity of the body
    b) Mass density of the fluid
    c) Projected area of the body
    d) All of the above

17. An isochrone is a line on the basin map joining the points
    a) of equal snowfall
    b) of rain gauge locations
    c) having equal time of travel of surface run-off to the catchment outlet
    d) none of the above

18. The best unit period of a unit hydrograph, is equal to basin lag divided by
    a) 2
    b) 3
    c) 4
    d) 5

19. The S-curve can be used to obtain a unit hydrograph from that of
    a) A longer duration
    b) Shorter duration
    c) Normal duration
    d) Both (a) and (b) above

20. In a flood hydrograph, if A is the catchment area, the duration of surface run-off from the time of occurrence of peak is proportional to A^{m}, where m is an exponent having value approximately.
    a) 0.2
    b) 0.33
    c) 0.667
    d) 1.0

21. Unit hydrograph theory assumes
    a) Linear response and time variance
    b) Linear response and time invariance
    c) Non- linear response and time invariance
    d) Non- linear response and time variance

22. The factor which affect the evapo – transpiration are
    a) Crop factors like type of crops and stage of its growth
    b) A climate factors like mean temperature, hours of bright sunshine, wind velocity, humidity etc
    c) The moisture level in the soil
    d) All the above

23. Blaney – Criddle equation is used to determine the
    a) Run off from a catchment
    b) Evaporation from a water surface
    c) Evapo-transpiration loss
    d) Maximum flood flow from a storm.

24. The relation between duty D in hectares/cumec, depth of water Δ in meters and base period B in days is given by
    a) Δ = 8.64 B/D
    b) Δ = 8.64 D/B
    c) Δ= 8.64 B
    d) None of these
25. If the moisture content of air remains constant, its relative humidity
    a) Increases if temperature of air increases
    b) Decreases if temperature of air increases
    c) Has no variation with variation in temperature
    d) None of these
26. A line joining places of equal rainfall, is called a
    a) Hyetograph
    b) Isobar
    c) Isotherm
    d) Isohyets

27. The ratio of maximum hourly consumption and average hourly consumption of the maximum day, is
    a) 1.2
    b) 1.5
    c) 1.8
    d) 2.7

28. In annual rate of increase method for the estimation of population, the population at the end of n years is given by $P_n = P (1 + I)^n$. In this relation i is
    a) A constant
    b) Number of years
    c) Annual rate of increase of population
    d) None of the these

29. Water Sedimentation process, involves the settling of the impurities in a tank, under the action of
    a) Sun rays
    b) Gravitational force
    c) Biological action
    d) Flow velocity of particles

30. Displacement efficiency of water sedimentation tanks, generally varies between
    a) 0 to 25 %
    b) 25 to 50%
    c) 50 to 75 %
    d) 75 to 100%

31. Methods of de-salination of water is
    a) Distillation
    b) Electro-dialysis
    c) Reverse osmosis
    d) All of the above
32. Coagulants, used in water treatment function better when the raw water is
    a) Acidic
    b) Alkaline
    c) Neutral
    d) None of the above
33. Particles of around 1 micron (10^{-6}m)size are best removed by
    a) Filtration
    b) Plain sedimentation
    c) Chemical precipitation
    d) Chemical coagulation
34. The efficiency of removal of bacteria by a slow sand filter is
    a) 99%
    b) 90%
    c) 80%
    d) 75%

35. Rapid sand filter can remove turbidity from water to an extent of
    a) 15 to 20 ppm
    b) 20 to 25 ppm
    c) 25 to 30 ppm
    d) 35 to 40 ppm
36. The process, which involves chlorination beyond break point chlorination is known as
    a) Prechlorination
    b) Super chlorination
    c) Post chlorination
    d) Dechlorination

37. Disease, which is not considered to be water-borne is
    a) Small pox
    b) Typhoid
    c) Cholera
    d) Bacillary dysentery
38. Waste water from petroleum refinery is found to have foam. The recommended coagulant will be
    a) Polyamine
    b) Alum
    c) Ferric chloride
    d) Weak cationic solution

39. The pH value of sewage is determined with help of
    a) Imhoff cone
    b) Turbidimeter
    c) Potentiometer
    d) None of the above

40. To test the Chemical Oxygen Demand(C.O.D) of sewage, organic matter is oxidized by potassium dichromate in the presence of
    a) Hydrochloric acid
    b) Sulphuric acid
    c) Nitric acid
    d) Citric acid

41. The relation between theoretical oxygen demand(TOD), biochemical oxygen demand(BOD) and chemical oxygen demand (COD) is given by
    a) TOD>BOD>COD
    b) TOD >COD>BOD
    c) BOD>TOD>COD
    d) BOD>COD>TOD

42. For the design of sewers in India, the percentage of sewage discharge, is assumed as
    a) 25 – 30% of water supplied from water works
    b) 75 – 80% of water supplied from water works
    c) 100% of water supplied from water works
    d) None of the these

43. The ratio of minimum hourly flow to the average flow of sewage, is
    a) 1/3
    b) 1/2
    c) 2/3
    d) 3

44. The flow velocity in a sewer does not depend on
    a) Its grade
    b) Its length
    c) Its hydraulic mean depth
    d) Its roughness

45. The self cleaning velocity normally adopted for sewers is
    a) Less than 1 m/sec
    b) 1.0m/sec to 1.2m/sec
    c) 1.5m/sec to 2.0m/sec
    d) More than 2.0m/sec

46. The gradient of sewer is
    a) Given in the direction of natural slope of ground
    b) Given in the opposite direction of natural slope of ground
    c) Zero
47. More than 1 in 20The relationship between void ratio e and porosity ratio n is
    a) $n = \frac{e}{1-e}$
    b) e = n(1 + e)
    c) $e = \frac{1+n}{1-e}$
    d) $\frac{1+e}{1-e}$
48. The ratio of weight of water to the weight of solids in a given mass of soil, is known as
    a) Void ratio
    b) Porosity
    c) Specific Gravity
    d) Water content
49. An inorganic clay of high compressibility is represented by the symbol
    a) SM
    b) CH
    c) MH
    d) MI
50. Uniformity coefficient of a soil is
    a) Always less than 1
    b) Always equal to 1
    c) Equal to or less than 1
    d) Equal to or greater than 1
51. If in partially saturated soil, the degree of saturation is 40% then air content of the soil is
    a) 40%
    b) 50%
    c) 60%
    d) 100%
52. Newmark's chart is used in foundation Engineering to find :
    a) Stresses in soil due to surface loading
    b) Seepage loss
    c) Earth pressure
    d) Permeability of soils

53. Vertical stress on a vertical line at a constant radial distance from the axis of a vertical load in a soil mass
    a) Is the same at all depth
    b) First increases, attains a maximum value, and then decreases
    c) Increases with the depth
    d) First decreases, attains a maximum value, and then increases.

54. The shear strength of a soil
    a) Is directly proportional to the angle of the soil
    b) Is directly proportional to the angle of internal friction of soil
    c) Increases with normal stress
    d) Decreases with an increase in the normal stress.

55. With increase in compaction energy in compaction tests
    a) $\gamma_{d\,max}$ and OMC both increase
    b) $\gamma_{d\,max}$ decreases and OMC increases
    c) $\gamma_{d\,max}$ increase and OMC decreases
    d) $\gamma_{d\,max}$ and OMC remain constant

56. For better strength and stability, coarse grained soils and fine grained soils are respectively compacted as
    a) Dry of OMC and wet of OMC
    b) Wet of OMC and dry of OMC
    c) Wet of OMC and wet of OMC
    d) Dry of OMC and dry of OMC

57. The achieved density during construction of an earthen bound under OMC conditions, can be tested by
    a) Core cutter method
    b) Sand replacement method
    c) Both (a) and (b) above
    d) None of the above

58. For normally consolidated clays, compression index can be determined from the empirical formula
    a) C_o=0.009(LL - 10)
    b) C_o=0.007(LL - 10)
    c) C_o=0.009(LL - 20)
    d) C_o=0.009(LL - 15)

59. Coefficient of consolidation (C_v) for clays generally
    a) Decreases with increase in liquid limit
    b) Increases with increase in liquid limit
    c) Initially increases and then decreases with increase in the liquid limit
    d) Remains constant at all values of liquid limit

60. Increase in effective stress on a soil mass
    a) Increase the void ratio and decreases the permeability
    b) Increases the void ratio and increases the permeability
    c) Decreases the void ratio and decrease the permeability
    d) Decreases the void ratio and increases the permeability

61. Methods more suitable for determining the permeability of coarse – grained soils, is
    a) Constant head permeameter
    b) Falling head pereameter
    c) Horizontal permeability test
    d) None of the these

62. As per IRC, the maximum permissible road re axle is
    a) 6.165 tons
    b) 8.165 tons
    c) 10.273 tons
    d) None of the above
63. The concrete pavement is produced when the daily traffic load per lane exceeds
    a) 100 tons
    b) 1000 tons
    c) 5000 tons
    d) 10,000 tons

64. The bitumen grade 80/100 indicates
    a) Dynamic viscosity
    b) Kinematic viscosity
    c) Specific gravity
    d) Penetration

65. The lowest temperature at which the vapour of a substance momentarily takes fire but does not continue to burn is called
    a) Flash point
    b) Fire point
    c) Ignition point
    d) None of the above

66. In CBR test the value of CBR is calculated at
    a) 2.5mm penetration only
    b) 5.0 mm penetration only
    c) Both 2.5 mm and 5.0 mm penetrations
    d) None of the above.

67. The reactions in a statically determine structure can be obtained by
    a) Equilibrium conditions
    b) Equilibrium and compatibility considerations
    c) Compatibility considerations only
    d) None of the above.

68. Degree of kinematic indeterminacy of a pin jointed plane frame is
    a) J – 2r
    b) 3j – 2r
    c) 2j – r
    d) 3j- r

69. In the moment area method, the difference in slope between any two sections of a loaded flexural member is equal to the
    a) Area of the $\frac{M}{E1}$ diagram between these two sections
    b) Moment of the $\frac{M}{E1}$ diagram between these two sections
    c) $\frac{1}{2}$ x area of the $\frac{M}{E1}$ diagram between these two sections
    d) $\frac{1}{2}$ x moment of the $\frac{M}{E1}$ diagram between these two sections

70. The slope-deflection method in structural analysis falls in the category of
    a) Force method
    b) Flexibility method
    c) Consistent-deformation method
    d) Stiffness method

71. If M is the external moment which rotates the near end of a prismatic beam without translation, the far end being fixed, then the movement induced at the far end is
    a) Zero
    b) $\frac{M}{2}$ in the same direction as M

c) $\frac{M}{2}$ in the opposite direction as M

d) None of the above

72. The carryover factor in prismatic member whose far end is hinged is

a) 0

b) 1/2

c) 3/4

d) 1

73. The number of plastic hinges which will cause the overall total collapse of the structure is

a) Equal to the order of statical indeterminacy

b) One more than the order of statical indeterminacy

c) One less than the order of statical indeterminacy

d) None of the above

74. Design of a structure based on the kinematic method of plastic analysis is on the

a) Suffer side

b) Upper bound side

c) Unsafe side

d) None of the above

75. Plastic deformation in steel structures are

a) Partly recoverable

b) Irrecoverable

c) Recoverable

d) Recoverable depending on the nature of the load

76. Slenderness ratio of a steel member is

a) Length/minimum side dimension

b) Effective length/ radius of gyration

c) Effective length/corresponding radius of gyration

d) Effective length/least radius of gyration

77. Lacing or battening of compound steel columns

a) Is a must

b) Increases the capacity

c) Decreases the buckling

d) Decrease local buckling

78. Battens provided in compound steel columns are mainly
    a) To increase the column capacity
    b) To decrease the buckling
    c) To provide unified behavior
    d) To prevent buckling

79. Allowable shear stress in stiffened webs of mild steel decreases with
    a) Increase in spacing of stiffners
    b) Decrease in spacing of stiffners
    c) Depends on the effective
    d) None of the above

80. The neutral axis of the Reinforced beam passes through
    a) C.G of the concrete section
    b) Meta centre of the concrete section
    c) Centroid of the concrete section
    d) Centroid of the transformed concrete section

81. The minimum percentage of tension reinforcement in R.C.C beam is
    a) 85/fy
    b) 0.4
    c) 40/fy
    d) 4

82. The number of tension reinforcement bars in R.C.C beam that can be spliced at any section should not exceed
    a) One third of the total
    b) One fourth of the total
    c) Zero
    d) Half of the total

83. A doubly reinforced beam is used
    a) When extra safety factor is required
    b) When the depth and width of beam have to be restricted
    c) When depth of beam is more then the width
    d) A large moment of resistance in desired.

84. The ratio of the diameter of reinforcing bars and the slab thickness is
    a) 1/5
    b) 1/6
    c) 1/7
    d) 1/8
85. Critical section for shear in case of flat slabs is at a distance of
    a) Effective depth of slab from periphery of column or drop panel
    b) d/2 from periphery of column or capital or drop panel
    c) at the drop panel of slab
    d) at the periphery of column
86. In a ring beam subjected to uniformly distributed load the
    a) Shear force at mid span is zero
    b) Torsion at mid span is zero
    c) Both (a)and (b)
    d) None of the above
87. The slenderness ratio of a R.C.C column is generally taken as
    a) l/r
    b) l/B
    c) l/D
    d) none
88. The design yield stress of steel according to IS:456 is
    a) 0.57fy
    b) 0.67fy
    c) 0.87fy
    d) None of the above
89. The load factors for live load and dead load are taken as
    a) 1.5 and 1.5
    b) 2.2 and 1.5
    c) 2.2 and 2.2
    d) 1.5 and 2.2
90. The maximum strain in concrete at the outermost compression fibre in bending is taken as
    a) 0.25%
    b) 0.30%
    c) 0.35%
    d) 0.40%