APPSC

Asst. Engineer in A.P. Rural Water Supply

Held on 16-06-2013

EA/634 **2013** Series **C**

CONCERNED SUBJECT

(English Version)

Paper – II

Time : 150 Minutes *Max. Marks : 150*

INSTRUCTIONS

1. Please check the Test Booklet and ensure that it contains all the questions. If you find any defect in the Test Booklet or Answer Sheet, please get it replaced immediately.

2. The Test Booklet contains **150** questions. Each question carries 1 mark.

3. The Test Booklet is printed in four (4) Series, viz. [A] [B] [C] [D]. The Series, [A] or [B] or [C] or [D] is printed on the right-hand corner of the cover page of the Test Booklet. Mark your Test Booklet Series [A] or [B] or [C] or [D] in Part C on side 1 of the Answer Sheet by darkening the appropriate circle with Blue/Black Ball point pen.

   Example to fill up the Booklet Series

   If your Test Booklet Series is **A**, please fill as shown below :

   ● Ⓑ Ⓒ Ⓓ

   If you have not marked the Test Booklet Series at Part C of side 1 of the Answer Sheet or marked in a way that it leads to discrepancy in determining the exact Test Booklet Series, then, in all such cases, your Answer Sheet will be invalidated without any further notice. No correspondence will be entertained in the matter.

4. Each question is followed by 4 answer choices. Of these, you have to select one correct answer and mark it on the Answer Sheet by darkening the appropriate circle for the question. If more than one circle is darkened, the answer will not be valued at all. Use Blue/Black Ball point pen to make heavy black marks to fill the circle completely. Make **no** other stray marks. Use of whitener is prohibited. If used the Answer Sheet is liable for invalidation.

   e.g. : If the answer for Question No. 1 is Answer choice (2), it should be marked as follows :

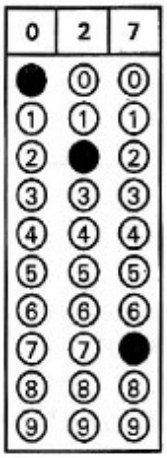
   1 | ① | ● | ③ | ④ |

5. Use Blue/Black Ball Point Pen only, failing which your Answer Sheet will be invalidated. Gel pens/pencils are not allowed. It is not required to darken the second copy separately.

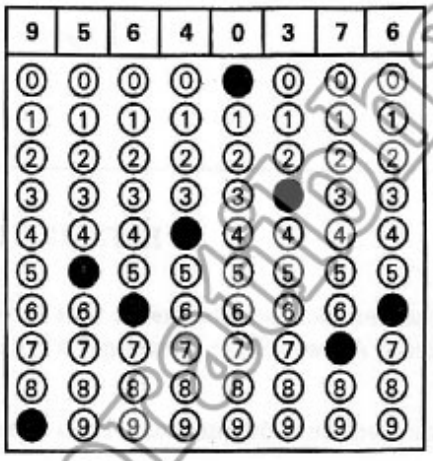
6. Mark Paper Code and Roll No. as given in the Hall Ticket with Blue/Black Ball point pen by darkening appropriate circles in Part A of side 1 of the Answer Sheet. Incorrect/not encoding will lead to ***invalidation*** of your Answer Sheet.

Example : If the Paper Code is **027**, and Roll No. is **95640376** fill as shown below :

Paper Code



Roll No.



7. Please get the signature of the Invigilator affixed in the space provided in the Answer Sheet. An Answer Sheet without the signature of the Invigilator is liable for ***invalidation***.

8. DO NOT fold, tear, wrinkle, tie, staple, do any rough work or make any stray marks on the OMR Answer Sheet, otherwise your Answer Sheet will be invalidated.

9. Using the Whitener/Blade/Eraser or any kind of tampering to change the answers on OMR Answer Sheet will lead to invalidation.

10. Do **not** mark answer choices on the Test Booklet. Violation of this will be viewed seriously.

11. Before leaving the examination hall, the candidate should hand over the original OMR Answer Sheet (top sheet) to the Invigilator and carry the bottom sheet (duplicate) for his/her record, failing which disciplinary action will be taken.

1. Triangle law of forces is derived from _____.
   (1) parallelogram law of forces
   (2) law of transmissibility of forces
   (3) Newton's law of gravitation
   (4) All the above

2. The resultant of two forces each equal to P/4 and acting at right angles is _____.
   (1) $\frac{P}{2}$
   (2) $\frac{P}{\sqrt{2}}$
   (3) $\sqrt{2}\,P$
   (4) 2P

3. What is the torque transmitted by a solid shaft of diameter (D), when subjected to a shear stress (τ) ?
   (1) $\frac{\pi}{16}\tau D^2$
   (2) $\frac{\pi}{16}\tau D^3$
   (3) $\frac{\pi}{32}\tau D^2$
   (4) $\frac{\pi}{32}\tau D^3$

4. When a solid shaft is subjected to torsion, the shear stress induced in the shaft at its centre is
   (1) zero
   (2) minimum
   (3) maximum
   (4) average

5. Strain energy stored in a hollow circular shaft of external diameter D and internal diameter d when subjected to a shearing stress τ is equal to
   (1) $\frac{\tau^2}{2c}\left(\frac{D^2-d^2}{D}\right)\times$ Volume of shaft
   (2) $\frac{\tau^2}{2c}\left(\frac{D^2+d^2}{D}\right)\times$ Volume of shaft
   (3) $\frac{\tau^2}{4c}\left(\frac{D^2-d^2}{D}\right)\times$ Volume of shaft
   (4) $\frac{\tau^2}{4c}\left(\frac{D^2+d^2}{D}\right)\times$ Volume of shaft

6. Find the maximum shear stress induced in a solid circular shaft of diameter 200 mm when the shaft transmits 190 kW power at 200 rpm.
   (1) 4·67 N/mm^2
   (2) 5·78 N/mm^2
   (3) 5·14 N/mm^2
   (4) 6·12 N/mm^2

7. Euler's buckling formula is applicable for columns
   (1) subjected to eccentric loads
   (2) having inertial curvature
   (3) initially straight and subjected to only axial loads
   (4) All of the above

8. A cantilever of length of span l carries a uniformly distributed load of w per unit length over its entire span. If its span is halved, then its slope will become
   (1) half
   (2) one-fourth
   (3) one-eighth
   (4) one-sixteenth

9. A cantilever beam of span l is carrying a triangular load of zero intensity at its free end to w per unit length at its fixed end. The deflection at its free end will be

(1) $Wl^4/30EI$

(2) $Wl^4/24EI$

(3) $Wl^4/16EI$

(4) $Wl^4/12EI$

10. The shear force at any section of the conjugate beam is equal to the slope of the elastic curve at the corresponding section of the actual beam.

The above theorem belongs to :

(1) Mohr's theorem I

(2) Mohr's theorem II

(3) Conjugate beam theorem I

(4) Conjugate beam theorem II

11. If the actual beam has both ends fixed, then the ends of the conjugate beam will be

(1) Fixed at both ends

(2) Free at both ends

(3) Fixed at one end, free at other end

(4) Hinged at one end, free at other end

12. All the members in a planar truss are _____ force members.

(1) Two

(2) Three

(3) Four

(4) None of these

13. Forces at the ends of the member act _____ member in a plane truss.

(1) perpendicular to

(2) along the axis of

(3) inclined to

(4) inclined at 30° to

14. All the loadings in plane truss are applied at _____ .

(1) any point in the member

(2) joints

(3) mid points

(4) base

15. Relation between number of members (m) and joints (j) in a plane truss is

(1) $m - 3 = 4 (j - 3)$

(2) $m - 2 = 4 (j - 2)$

(3) $m - 3 = 2 (j - 3)$

(4) $m - 2 = 2 (j - 2)$

16. An ideal flow of any fluid must fulfil the following :

(1) Newton's law of viscosity

(2) Newton's law of motion

(3) Boundary layer theory

(4) Continuity equation

17. The stress-strain relation of the Newtonian fluids is

(1) Linear

(2) Parabolic

(3) Hyperbolic

(4) Involutic

18. The velocity distribution in a laminar flow through a circular pipe follows as
    (1) parabolic
    (2) linear law
    (3) logarithmic law
    (4) None of the above

19. The units of kinematic viscosity are
    (1) kg/m^2-sec
    (2) kg-sec/m^2
    (3) m/kg-sec
    (4) m^2/sec

20. Froude's number is defined as the ratio of
    (1) inertia force to viscous force
    (2) inertia force to gravity force
    (3) inertia force to elastic force
    (4) inertia force to pressure

21. Differential manometers are used for measuring
    (1) velocity at a point in a fluid
    (2) pressure at a point in a fluid
    (3) pressure difference between two points
    (4) All of the above

22. A rotameter is a device used to measure
    (1) Velocity of fluid in pipes
    (2) Velocity of gauges
    (3) Vortex flow
    (4) Flow of fluids

23. Surface tension is a phenomenon due to
    (1) cohesion only
    (2) viscous force
    (3) adhesion between liquid and solid molecules
    (4) difference in magnitude between the forces due to adhesion and cohesion

24. A measure of the effect of compressibility in fluid flow is the magnitude of a dimensionless parameter known as
    (1) Reynolds number
    (2) Mach number
    (3) Weber number
    (4) Froude number

25. For air flow at room temperature to be incompressible, the fluid velocity must not exceed
    (1) 100 m/sec
    (2) 70 m/sec
    (3) 50 m/sec
    (4) 25 m/sec

26. Mercury is used in barometers on account of
    (1) its high density
    (2) negligible capillarity effect
    (3) very low vapour pressure
    (4) its low compressibility

27. Which of the following fluids has the highest compressibility ?

(1) Water

(2) Air at 1 atm. pressure

(3) A gas at 5 atm. pressure

(4) All of (1), (2) & (3)

28. The pressure gradient in the horizontal direction in a static fluid is represented by

(1) $\frac{\partial p}{\partial z} = -\gamma$

(2) $\frac{\partial p}{\partial x} = \gamma$

(3) $\frac{\partial p}{\partial x} = 0$

(4) $\frac{\partial p}{\partial z} = 0$

where z direction is vertically upwards, and x is along horizontal.

29. Flow of a fluid in a pipe takes place from

(1) higher level to lower level

(2) higher pressure to lower pressure

(3) higher energy to lower energy

(4) None of the above

30. The point through which the resultant hydrostatic force acts is called

(1) metacentre

(2) centre of pressure

(3) centre of buoyancy

(4) centre of gravity

31. An oil of specific gravity 0·7 and pressure 0·14 kgf/cm^2 will have the height of oil as

(1) 70 cm of oil

(2) 2 m of oil

(3) 20 cm of oil

(4) 80 cm of oil

32. The mean velocity in open channels can be estimated from the known velocity at the free surface. It is approximately equal to

(1) 0·88

(2) 0·75

(3) 0·65

(4) 1·10

33. The critical depth is the depth of flow at which

(1) the specific energy is maximum

(2) the unit discharge 'q' is minimum

(3) the specific energy is minimum

(4) the Froude number is greater than unity

34. In a subcritical flow, as the specific energy in a channel is decreased, the depth of flow

(1) also decreases

(2) increases

(3) does not vary

(4) approaches to a minimum value which corresponds to the minimum specific energy

35. In case of uniform flow in the channel, the water surface slope $\frac{dy}{dx}$ is equal to

(1) 1
(2) ∞
(3) 0
(4) 1000

36. A control section is one where a definite relationship between depth of flow and discharge exists. A critical depth section is a control section. Which of the following cases represents control sections ?

(i) Hydraulic jump
(ii) Flow under a sluice gate
(iii) Flow over a small hump
(iv) Overflow spillway
(v) Change of slope from mild to steep
(vi) Supercritical flow in channel

(1) ii, iv, v
(2) iv, v, vi
(3) v, iv, iii
(4) None of these

37. Mach number is a measure of compressibility effects in fluid flow. Indicate up to what mach number can a fluid flow be considered incompressible.

(1) 1
(2) 0·1
(3) 0·3
(4) 0·8

38. An isometric flow is one which is

(1) adiabatic
(2) isothermal
(3) isothermal and reversible
(4) adiabatic and irreversible

39. A shock wave which occurs in a supersonic flow represents a region in which

(1) there is no change in pressure, temperature and density
(2) there is sudden change in pressure, temperature and density
(3) a zone of silence exists
(4) velocity is zero

40. The sonic velocity in a fluid medium is directly proportional to

(1) square root of pressure
(2) square root of temperature
(3) density
(4) mach number

41. A fluid jet of cross-sectional area 'A' and velocity 'v' strikes a flat plate moving with a velocity 'u'. The fluid mass striking it for a second is

(1) ρAv
(2) $\rho A (v - u)$
(3) $\rho A (u - v)$
(4) $\rho A (v + u)$

42. The dynamic force exerted by a fluid of cross-section area 'A' and velocity 'v' on a moving flat plate held at right angles to the direction of jet is

(1) ρAvu

(2) $\rho A (v - u) u$

(3) $\rho A (v - u)^2$

(4) $\rho A (v + u) u$

'u' being the velocity of flat plate in the direction of the jet.

43. Turbines give best performance (i.e. work at peak efficiency) when they are operated at full or design load. The performance of many turbines deteriorates considerably at part loads. Which of the following turbines is best suited for operation at part loads ?

(1) Pelton turbine

(2) Francis turbine

(3) Propeller turbine

(4) Kaplan turbine

44. The power which appears in the expansion for the specific speed is

(1) the water horse power

(2) the horse power developed by the runner

(3) the shaft horse power (brake horse power)

(4) the power input to the turbine

45. The power obtainable from an impulse turbine is proportional to the number of nozzles used. A pelton turbine with six nozzles has a specific speed of 8·1. The specific speed per nozzle is

(1) 1·35

(2) 3·3

(3) 2

(4) 8·1

46. The difference between the power obtained from the turbine shaft and the power supplied by water at its entry to the turbine is equal to the

(1) hydraulic losses

(2) mechanical losses

(3) hydraulic and mechanical losses

(4) mechanical and volumetric losses

47. Cavitation, being related to occurrence of low pressure in flow, would definitely occur if

(1) the pressure anywhere in the flow approaches the atmospheric value

(2) the pressure anywhere in the flow falls to a value very close to the vapour pressure of the liquid at the prevailing temperature

(3) the pressure is lower than the vapour pressure

(4) None of the above

48. The velocity with which the water approaches a notch is called

(1) velocity of flow

(2) velocity of approach

(3) velocity of whirl

(4) None of the above

49. Power transmitted through pipes will be maximum when head lost due to friction is equal to

(1) $\frac{1}{2}$ total head at the inlet of the pipe

(2) $\frac{1}{4}$ total head at the inlet of the pipe

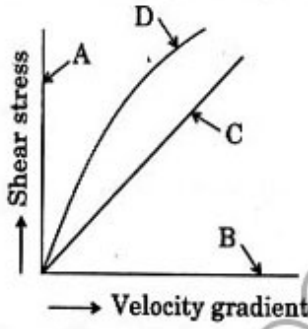
(3) total head at the inlet of the pipe

(4) $\frac{1}{3}$ total head at the inlet of the pipe

50. A body is called a stream lined body when it is placed in a flow and the surface of the body
(1) coincides with the stream lines
(2) does not coincide with the stream lines
(3) is perpendicular to the stream lines
(4) is inclined to the stream lines

51. The entrance length or length of establishment of flow is
(1) the pipe length inside the reservoir
(2) the initial length in which the flow develops fully such that the velocity profile does not change downstream
(3) the length in which the boundary layer remains uniform
(4) the length of pipe from its entrance in which the flow may be assumed irrotational

52. Curve-D in Fig. corresponds to



(1) ideal fluid
(2) Newtonian fluid
(3) non-Newtonian fluid
(4) non-ideal fluid

53. The energy loss in pipe lines is due to
(1) viscous action
(2) surface roughness only
(3) friction offered by pipe walls as well as by the various actions
(4) turbulent shear stress alone

54. In flow through pipe bends, the pressure on inner and outer radii
(1) do not vary and are the same as at the centre of pipe
(2) vary, it being more on the inner one
(3) are different; pressure increases with increase in radius and is, therefore, more at the outer radius
(4) stand at the same level increasing gradually towards the pipe centre

55. Vorticity is given by _____ times the rotation.
(1) 1
(2) 2
(3) 3
(4) 4

56. The condition for maximum transmission of power through a pipe line is that one-third of the available head must be consumed in friction. The corresponding efficiency of pipe line is
(1) 66·67%
(2) 33·3%
(3) 100%
(4) $\sqrt{2}/33$

57. In order to have a continuous flow through a siphon, no portion of the pipe should be higher than
(1) 10 m
(2) 10·33 m
(3) 5·5 m
(4) 7·75 m

58. Water hammer is a phenomenon which is caused by

(1) sudden opening of a valve in a pipe line

(2) sudden closing of a valve in a pipe line

(3) incompressibility of fluid

(4) the pipe material being elastic

59. A surge tank is a device connected to the penstock pipe line and installed as close to the powerhouse as the topography of the area permits. The main function of the surge tank is to

(1) restrict the water hammer effects to a small length of penstock

(2) provide a free-water surface near the turbines

(3) act as a reservoir

(4) protect the penstock pipe line from bursting

60. The difference in pressure head, measured by a mercury water differential manometer for a 20 cm difference of mercury level will be

(1) 2·72 m

(2) 2·52 m

(3) 2·0 m

(4) 0·2 m

61. The hydrostatic pressure on a plane surface of area 'A' is given by

(1) $0{\cdot}5\ \gamma A h_c$

(2) $\gamma A h_c$

(3) $2\ \gamma A h_c$

(4) $1{\cdot}5\ \gamma A h_c$

where h_c = depth of centroid of the area below the liquid surface.

62. When a static liquid is subjected to uniform rotation in a container, the free surface assumes a shape of :

(1) a cone

(2) a circular cylinder

(3) a paraboloid of revolution

(4) an ellipsoid of revolution

63. A circular plate 1 m in diameter is submerged vertically in water such that its upper edge is 8 m below the free surface of water. The total hydrostatic pressure force on one side of the plate is

(1) 6·7 kN

(2) 65·4 kN

(3) 45·0 kN

(4) 77·0 kN

64. The flow in a river during the period of heavy rainfall is

(1) steady, uniform, two-dimensional

(2) unsteady, uniform, three-dimensional

(3) unsteady, non-uniform and three-dimensional

(4) steady, non-uniform and three-dimensional

65. A water supply pipe line changes its alignment through a bend. When the flow in the pipe line is increased by operating a valve, the flow in the bend is classified as

(1) unsteady, uniform flow

(2) unsteady, non-uniform flow

(3) steady, uniform flow

(4) steady, non-uniform flow

66. The continuity equation in fluid mechanics is a mathematical statement embodying the principle of

(1) conservation of energy

(2) conservation of mass

(3) conservation of momentum

(4) None of the above

67. The concept of stream function which is based on the principle of continuity is applicable to

(1) three-dimensional flow

(2) two-dimensional flow only

(3) uniform flow cases only

(4) irrotational flow only

68. The velocity potential function for a source varies with distance 'r' as

(1) $\frac{1}{r}$

(2) $\frac{1}{r^2}$

(3) e^r

(4) $ln\ r$

69. A stagnation point is a point

(1) where the pressure reduces to zero

(2) where the total energy is zero

(3) where the velocity of flow reduces to zero

(4) where the total energy is maximum

70. A venturimeter is a device based on the Bernoulli principle and is used for measuring

(1) piezometric head

(2) velocity head

(3) flow rate

(4) total energy

71. The total-energy-line is always higher than the hydraulic grade line. The vertical distance between the two represents

(1) the datum head

(2) the pressure head

(3) the velocity head

(4) the piezometric head