

Candidate's Roll Number

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Question Booklet Series

Question Booklet

<b>A</b>
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## GENERAL PAPER

Time Allowed : 3 Hours
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Maximum Marks : 150
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Read the following instructions carefully before you begin to answer the questions.

### IMPORTANT INSTRUCTIONS

1. This Question Booklet contains 150 questions in all.
2. All questions carry equal marks.
3. Attempt all questions.
4. Immediately after commencement of the examination, you should check up your Question Booklet and ensure that the Question Booklet Series is printed on the top right-hand corner of the Booklet. The Booklet contains 23 printed pages and no page or question is missing or unprinted or torn or repeated. If you find any defect in this Booklet, get it replaced immediately by a complete Booklet of the same series.
5. You must write your Roll Number in the space provided on the top of this page. Do not write anything else on the Question Booklet.
6. An OMR Answer Sheet will be supplied to you separately by the Invigilator to mark the answers. You must write your Name, Roll No. and other particulars on the first page of the OMR Answer Sheet provided, failing which your OMR Answer Sheet will not be evaluated.
7. You will encode your Roll Number and the Question Booklet Series A, B, C or D as it is printed on the top right-hand corner of this Question Booklet with Black/Blue ballpoint pen in the space provided on Page-2 of your OMR Answer Sheet. If you do not encode or fail to encode the correct series of your Question Booklet, your OMR Answer Sheet will not be evaluated correctly.
8. Questions and their responses are printed in English only in this Booklet. Each question comprises four responses—(A), (B), (C) and (D). You are to select ONLY ONE correct response and mark in your OMR Answer Sheet. In case you feel that there are more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each question. Your total marks will depend on the number of correct responses marked by you in the OMR Answer Sheet.
9. In the OMR Answer Sheet, there are four circles—(A), (B), (C) and (D) against each question. To answer the questions you are to mark with Black/Blue ballpoint pen ONLY ONE circle of your choice for each question. Select one response for each question in the Question Booklet and mark in the OMR Answer Sheet. If you mark more than one answer for one question, the answer will be treated as wrong. Any erasure or change is not allowed.
10. You should not remove or tear off any sheet from the Question Booklet. You are not allowed to take this Question Booklet and the OMR Answer Sheet out of the Examination Hall during the examination. After the examination has concluded, you must hand over your OMR Answer Sheet to the Invigilator. Thereafter, you are permitted to take away the Question Booklet with you.
11. Failure to comply with any of the above instructions will render you liable to such action or penalty as the Commission may decide at their discretion.

SEAL

(A)

1. Light-emitting diode is an example of  
 (A) photonic devices  
 (B) mechanical devices  
 (C) optoelectronic devices  
 (D) sensing devices
2. The premature ignition of fuel is called  
 (A) engine knock  
 (B) autoignition  
 (C) detonation  
 (D) All of the above
3. Skin stress is also called as  
 (A) shear stress  
 (B) bending stress  
 (C) lateral stress  
 (D) temperature stress
4. National Science Day is celebrated on  
 (A) 26th December  
 (B) 26th January  
 (C) 28th February  
 (D) 5th September
5. Which of the following is **not** a part of venturimeter?  
 (A) Diverging part  
 (B) Converging part  
 (C) Working fluid  
 (D) Throat
6. What is the principle of the 'Johansson Mikrokator'?  
 (A) Button spinning on a loop of string  
 (B) Principle of interference  
 (C) Optical magnification  
 (D) Principle of transformer
7. At 0 °C, silicon behaves as a/an  
 (A) conductor  
 (B) insulator  
 (C) semiconductor  
 (D) superconductor
8. Temperature stress is a function of ~~linear~~ <sup>of  $\alpha$  and  $\Delta T$</sup>  ~~of  $\alpha$  and  $\Delta T$~~   
 (A) coefficient of linear expansion  
 (B) change in temperature  
 (C) modulus of elasticity  
 (D) All of the above
9. Who has served as the 11th President of India?  
 (A) Shri Pranab Mukherjee  
 (B) Shri K. R. Narayanan  
 (C) Shri A. P. J. Abdul Kalam  
 (D) Smt. Pratibha Patil
10. NASA was established in the year  
 (A) 1915  
 (B) 1950  
 (C) 1958  
 (D) 1985

11. When air passes through silica gel  
 (A) it absorbs water vapour molecules  
 (B) latent heat of condensation is released  
 (C) DBT of air increases  
 ✓(D) All of the above
12. Which of the following screw threads is stronger than other threads?  
 (A) Square threads  
 ✓(B) Trapezoidal threads  
 (C) Buttress threads  
 (D) V threads
13. In Physics, the Nobel Prize, 2014 was awarded for the discovery of  
 (A) gravitational waves  
 ✓(B) blue light LED  
 (C) neutrino oscillations  
 (D) MRI
14. In India, 15th September is celebrated as  
 ✓(A) Engineer's Day  
 (B) Scientist's Day  
 (C) Labour's Day  
 (D) Women's Day
15. Ministry of Science and Technology was formed in the year  
 (A) 1950  
 (B) 1971  
 (C) 1985  
 ✓(D) 1992
16. Who among the following scientists has made his contribution in the establishment of ISRO?  
 (A) A. P. J. Abdul Kalam  
 (B) C. V. Raman  
 ✓(C) Vikram Sarabhai  
 (D) Aryabhata
17. Dr. B. R. Ambedkar was independent India's first  
 (A) Textile Minister  
 ✓(B) Law Minister  
 (C) HRD Minister  
 (D) Foreign Minister
18. Graphene is a  
 (A) one-dimensional material  
 ✓(B) two-dimensional material  
 (C) three-dimensional material  
 (D) All of the above
19. Bihar Diwas (Bihar Day) is observed every year on  
 (A) 25th March  
 (B) 22nd March  
 (C) 1st April  
 ✓(D) 1st March
20. Sardar Sarovar Dam is located on  
 (A) Ganga river  
 (B) Narmada river  
 ✓(C) Sutlej river  
 (D) Godavari river

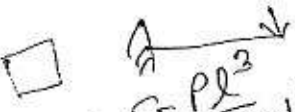
21. The First Bharat Ratna Award was given in the year  
(A) 1951  
(B) 1952  
 (C) 1953  
(D) 1954
22. Raxaul Airport is located in the State of  
(A) Goa  
(B) Maharashtra  
 (C) Bihar  
(D) Uttarakhand
23. Which of the following weldings is used for welding vertical section in one pass?  
 (A) Electroslag welding  
(B) Atomic hydrogen welding  
(C) Laser-beam welding  
(D) Electrogas welding
24. Rateau turbine belongs to the category of  
 (A) pressure-compounded turbine  
(B) reaction turbine  
(C) velocity-compounded turbine  
(D) radial flow turbine
25. Gradually varied flow is  
(A) steady uniform  
(B) non-steady non-uniform  
(C) non-steady uniform  
 (D) steady non-uniform
26. The temperature of normal human body is  
(A) 38.6 °C  
(B) 37 °C  
 (C) 37.6 °C  
(D) 38 °C
27. Who was the founder of Aligarh Muslim University?  
 (A) Sir Syed Ahmad Khan  
(B) Mohammad Ali Jinnah  
(C) Abul Kalam Azad  
(D) Ram Mohan Roy
28. Mr. Jagadish Chandra Bose is a famous scientist for the invention of  
 (A) Bose-Einstein statistics  
(B) crescograph  
(C) X-rays  
 (D) scattering of light
29. Albert Einstein was awarded the Nobel Prize for  
 (A) theory of relativity  
(B) quantum optics  
(C) photoelectric effect  
(D) Bose-Einstein theory
30. Rana Pratap Sagar Dam is situated on  
(A) Chambal river  
 (B) Yamuna river  
(C) Narmada river  
(D) Brahmaputra river

31. An instrument, that is used for the detection of earthquake, is  
(A) barometer  
(B) lactometer  
 (C) seismograph  
(D) holograph
32. The Head Office of the Central Pollution Control Board (CPCB) is located in  
(A) Mumbai  
(B) Kolkata  
 (C) Patna  
(D) None of the above
33. RDX is a chemical compound. How is it used?  
(A) As a composition  
(B) As a reactor  
 (C) As an explosive  
(D) As a nuclear weapon
34. The planet Neptune was discovered by  
 (A) Galle  
(B) Galileo  
(C) Kepler  
(D) Newton
35. Resistance of which of the following is unaffected by temperature?  
(A) Manganin  
(B) Constantan  
(C) Nichrome  
 (D) All of the above
36. Which of the following is the first calculating device?  
 (A) Abacus  
(B) Calculator  
(C) Turing machine  
(D) Pascaline
37. Name the polymer used in making bulletproof glass.  
(A) Melamine  
 (B) Bakelite  
(C) Lexan  
(D) Vinyl rubber
38. Where was the World Wide Web created and in which year?  
 (A) CERN, 1989  
(B) Photonics 21, 1989  
(C) CLUSTER, 1995  
(D) Gikll, 1993
39. Name an acid which is secreted in the stomach.  
(A) Sulphuric acid  
 (B) Hydrochloric acid  
(C) Carbonic acid  
(D) Nitric acid
40. The term 'CTBT' is related to  
(A) nuclear weapons  
(B) taxes  
 (C) space research  
(D) railway goods

41. India's first mobile court was inaugurated in  
 (A)  Maharashtra  
 (B) Haryana  
 (C) Uttar Pradesh  
 (D) Rajasthan
42. In which year, railway finances were separated from the general finances of the Central Government?  
 (A) 1920  
 (B) 1972  
 (C)  1923  
 (D) 1924
43. Logarithm tables were invented by  
 (A) J. J. Thomson  
 (B) John Napier  
 (C)  Paul Ehrlich  
 (D) A. G. Bell
44. What is India's per capita emission of greenhouse gases (GHG)?  
 (A) 0.8 tonne of CO<sub>2</sub>  
 (B) 1.0 tonne of CO<sub>2</sub>  
 (C)  1.2 tonnes of CO<sub>2</sub>  
 (D) 1.5 tonnes of CO<sub>2</sub>
45. A new study provided the first evidence that fatter people may be more affected by exposure to  
 (A) sunlight  
 (B) X-rays  
 (C)   $\gamma$ -rays  
 (D) ozone
46. Which of the following units is used for measuring the speed of processor?  
 (A) MPIS  
 (B) MISP  
 (C)  MIPS  
 (D) MSIP
47. Nerves from the eyes and ears are connected to the  
 (A)  cerebrum  
 (B) cerebellum  
 (C) medulla oblongata  
 (D) spinal cord
48. Rainbow Revolution is related to which sector of the economy?  
 (A)  Small-scale industries  
 (B) Information technology services  
 (C) Overall development of agriculture sector  
 (D) Mining sector
49. Who among the following was the first economist to hold the Office of Secretary, Department of Economic Affairs in the Union Finance Ministry?  
 (A) Dr. I. G. Patel  
 (B)  Dr. Manmohan Singh  
 (C) Rakesh Mohan  
 (D) Dr. M. S. Ahluwalia
50. Who is the author of *Soul and Structure of Governance in India*?  
 (A) V. K. Duggal  
 (B) Jairam Ramesh  
 (C)  Dr. I. G. Patel  
 (D) Jagmohan

51. A cantilever beam of rectangular cross-section is subjected to a point load at its free end. If width and depth of the beam section are doubled, then the deflection at free end of the beam will be reduced to

- (A) 6.25%
- (B) 15%
- (C) 25.5%
- (D) 29%



$$\delta = \frac{PL^3}{3EI}$$

$$\frac{\delta_1}{\delta_2} = \frac{P L^3}{3 E (2b)(2d)^3} \times \frac{3 E b d^3}{P L^3} = \frac{1}{16}$$

52. The ratio of maximum shear stress to average shear stress in a beam of rectangular cross-section is

- (A) 3.0
- (B) 2.5
- (C) 2.0
- (D) 1.5

$\tau_{max} = \frac{3}{2} \tau_{avg}$

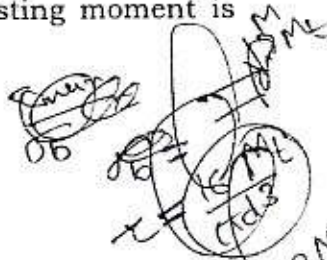
53. In a symmetrical I-section beam, the bending stress will be maximum at

- (A) the neutral axis
- (B) the top and bottom of the beam section
- (C)  $\frac{1}{4}$ th depth from top and bottom of section
- (D) the junction of flange and web



54. A circular shaft is subjected to a twisting moment  $M_t$  and bending moment  $M$ . The ratio of maximum stress developed due to bending moment and that due to twisting moment is equal to

- (A)  $\frac{2M}{3M_t}$
- (B)  $\frac{2M}{M_t}$
- (C)  $\frac{M}{M_t}$
- (D)  $\frac{M}{2M_t}$



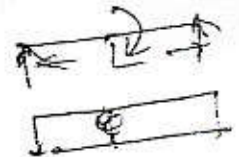
$$\tau_{max} = \frac{16T}{\pi d^3}$$

$$\sigma_b = \frac{32M}{\pi d^3}$$

$$\frac{\sigma_b}{\tau_{max}} = \frac{32M}{\pi d^3} \times \frac{\pi d^3}{16T} = \frac{2M}{M_t}$$

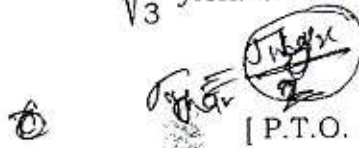
55. If a simply-supported beam of span  $L$  carries a moment force at its mid-span, then the shear force diagram will be

- (A) triangular
- (B) rectangular
- (C) parabolic
- (D) cubic parabolic



56. According to maximum shear stress criterion, yielding in material occurs when

- (A) maximum shear stress = 2 yield stress
- (B) maximum shear stress = 0.5 yield stress
- (C) maximum shear stress =  $\sqrt{2}$  yield stress
- (D) maximum shear stress =  $\frac{\sqrt{2}}{3}$  yield stress



$$\tau_{max} = \frac{\sigma_1 - \sigma_2}{2}$$

57. A frictionless pin joint transmits a

- (A) force which passes through the pin
- (B) torque about the pin
- (C) moment about the pin
- (D) All of the above

58. A bar held between two rigid supports will be subjected to tensile stress if it is

- (A) heated
- (B) cooled
- (C) heated or cooled
- (D) heated beyond the melting point



59. A linear helical spring with spring constant  $K$  is cut into two equal halves. The spring constants of the individual halves will be

- (A)  $K/2$
- (B)  $K/\sqrt{2}$
- (C)  $\sqrt{2}K$
- (D)  $2K$

$$K \propto \frac{1}{n}$$

60. In a body, loaded under plane stress conditions, the number of independent stress components in order to completely specify the state of stress at a point is

- (A) 1
- (B) 3
- (C) 4
- (D) 6

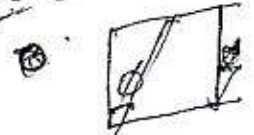
61. A shaft of 60 mm diameter is subjected to torsion has a shear strain of 0.0006. The rate of twist will be equal to

- (A) 0.00002
- (B) 0.00025
- (C) 0.0036
- (D) 0.00001

$$\theta = \frac{\tau}{G}$$

$$\theta = \frac{T L}{G J} \quad d = 60$$

$$E = 0.0006$$



62. The equivalent spring constant for a bar of length  $L$ , cross-sectional area  $A$  and modulus of elasticity  $E$  is subjected to an axial force  $P$  is

- (A)  $AE/L$
- (B)  $L/AE$
- (C)  $PL/A$
- (D)  $P^2L/2AE$

$$\Delta = \frac{PL}{AE}$$

$$\frac{AE}{L} \Delta = P$$

63. The no-slip boundary condition applied in a fluid

- (A) is a consequence of laminar behaviour of fluid
- (B) because the fluid is treated as continuous
- (C) because the fluid is incompressible
- (D) because the fluid is viscous



$$R = \frac{8 \mu R \omega^2}{2g}$$

$$z = \frac{r^2 \omega^2}{2g}$$

64. When a liquid rotates at constant angular velocity about a vertical axis as a rigid body, the pressure intensity

- (A) decreases as the square of radial distance  $\propto$
- (B) increases linearly as radial distance
- (C) varies inversely as the elevation along any vertical line
- (D) varies as square of radial distance

65. A small plastic boat loaded with nuts and bolts is floating in a bathtub. If the cargo is dumped into water, allowing the boat to float empty, the water level in the tub will

- (A) rise
- (B) fall
- (C) remain same
- (D) None of the above



66. Nusselt number is the ratio of

- (A) temperature gradient of wall to that across the entire pipe
- (B) temperature difference to the temperature gradient at the wall
- (C) heat flux at the wall to that across the entire pipe
- (D) None of the above

$$Nu = \frac{hL_c}{K}$$

$$\frac{q_{conv}}{q_{cond}}$$

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$$\frac{q_{conv}}{q_{cond}} =$$

$$\frac{hA_s(\Delta T)}{-KA \frac{dT}{dx}}$$

$$\frac{hL_c(\Delta T)}{K(\Delta T)}$$

67. The momentum correction factor for laminar flow through a circular pipe is

- (A) 1.67
- (B) 3.0
- (C) 0.85
- (D) 1.33

$$\alpha = 2$$

$$\beta = 1.33$$

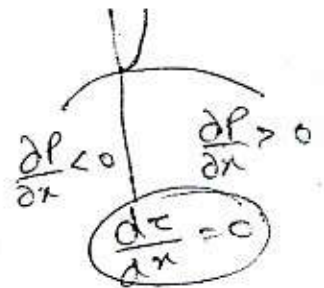
68. The velocity distribution for laminar flow between two parallel plates

- (A) is constant over the whole cross-section
- (B) is zero at the boundary and increases linearly towards the centre line
- (C) varies linearly across the section with a maximum at the centre line
- (D) varies parabolically across the section with a maximum at the centre line

D

69. The growth of boundary layer is supported when ( $p$  is the pressure and  $x$  is the distance from the leading edge)

- (A)  $\frac{\partial p}{\partial x}$  is positive
- (B)  $\frac{\partial p}{\partial x}$  is zero
- (C)  $\frac{\partial p}{\partial x}$  is negative
- (D) None of the above



[P.T.O.]

70. Turbulent boundary layer thickness is proportional to

- (A)  $1/x$   
 (B)  $x^{1/5}$   
 (C)  $x^{2/5}$   
 (D)  $x^{4/5}$

$\delta = \frac{0.37 x}{Re_x^{1/4}}$   
 $\Rightarrow x^{4/5}$   
 $\frac{1}{5}$

74. In a parallel R-L-C circuit, the values of R, L and C are 40 ohms, 2 henries and 1/2 farad respectively. The quality factor Q of the circuit will be

- (A) 1/20  
 (B) 20  
 (C) 40  
 (D) 80

$Q = \frac{1}{2\pi\sqrt{LC}}$   
 $\Rightarrow \frac{1}{2\pi\sqrt{40 \cdot \frac{1}{2}}}$   
 $\frac{1}{2\pi}$   $\frac{1}{2}$

71. The value of friction factor for smooth pipes for Reynolds' number equal to 106 is approximately

- (A) 0.0001  
 (B) 0.001  
 (C) 0.01  
 (D) 0.1

$f = \frac{64}{Re}$   
 $\frac{64}{106}$   
 $\approx 0.6$

$\frac{64}{106}$   
 $\approx 0.6$

72. The time constant of an R-C circuit is one second. Then in one second the capacitor is charged to

- (A) about 66%  
 (B) about 98%  
 (C) 100%  
 (D) None of the above

$\tau = 1 \text{ sec}$

73. A linear circuit must obey

- (A) superposition theorem  
 (B) superposition theorem and Thevenin's theorem  
 (C) superposition, Thevenin's theorem and Norton's theorem  
 (D) superposition and Norton's theorem

76. In the Laplace transform

$F(s) = (s+2)/s(2s+1)$

the function  $f(t)$  as  $t \rightarrow \infty$  and  $t \rightarrow 0$  respectively are

- (A) 2, 0  
 (B) 0, 0.5  
 (C) 2, 0.5  
 (D) 0.5, 2

$F(s) = \frac{s+2}{s(2s+1)}$

$L\left[\frac{1}{s}\right] = e^t$

$2 + t + e^t$

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$L\left[\frac{1}{s}\right] = e^t$   
 $\frac{s+2}{s(2s+1)} = \frac{10}{2s+1} + \frac{s+1}{2s+1}$   
 $2 + \frac{1}{s} - \frac{s}{2s+1} + \frac{1}{2s+1}$

$$Q = \frac{1}{2\pi} \sqrt{\frac{L}{C}} \approx \omega_c = \omega_c \quad \frac{1}{\omega_c} = \log$$

77. Increasing the value of the coupling capacitor  $C_c$  in a common-emitter amplifier affects its

- (A) mid-band voltage gain
- (B)  $f_L$  (lower cut-off frequency)
- (C)  $f_H$  (higher cut-off frequency)
- (D)  $f_L$  and  $f_H$  both

78. The base width of a junction transistor is chosen by design to be small so that

- (A) the electric field becomes large
- (B) the concentration gradient of injected carriers is small
- (C) the recombination of injected minority carriers is reduced
- (D) the majority carriers easily reach the collector

79. To increase the switching speed of a  $p^+n$  diode

- (A) the  $n$  region width should be made larger
- (B) the  $n$  region width should be made smaller
- (C) the  $p$  region's bulk resistance should be larger
- (D) None of the above is true

80. Threshold voltage of a MOSFET can be reduced by

- (A) increasing the oxide thickness
- (B) reducing the dielectric constant of oxide
- (C) increasing the oxide thickness, and increasing the oxide dielectric constant
- (D) reducing the oxide thickness and increasing the oxide dielectric constant

81. A single-phase induction motor starts

- (A) due to the development of rotating field for single-phase a.c. supply
- (B) by applying voltage across the stator with the help of autotransformer
- (C) by changing the number of poles in the stator winding
- (D) None of the above

82. Transformer core is made of lamination to reduce

- (A) eddy-current loss only
- (B) hysteresis loss only
- (C) both hysteresis and eddy-current loss
- (D) None of the above

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$$R = 40$$

$$L = 2$$

$$C = 1/2$$

$$Q =$$

11

$$f = \frac{1}{2\pi} \sqrt{\frac{L}{C}}$$

$$= \frac{1}{2\pi} \sqrt{\frac{2}{1/2}} = \frac{1}{2\pi} \sqrt{4} = \frac{1}{\pi}$$

Series

$n = \frac{fP}{60}$  ~~60~~  $\frac{50 \times 12}{60}$   $n = \frac{60 \times P}{f}$

83. When a two-winding transformer is connected as an auto-transformer, its efficiency (full-load)
- (A) remains the same
  - (B) increases
  - (C) decreases
  - (D) rises to 100%
84. Which of the following motors runs at constant speed at all loads?
- (A) Synchronous motor
  - (B) Induction motor
  - (C) DC shunt motor
  - (D) DC series motor
85. Four-point starter is used for
- (A) synchronous motor
  - (B) induction motor of large capacity
  - (C) DC shunt motor with wide range of speed
  - (D) DC series motor with heavy load
86. The electromechanical energy conversion is a/an
- (A) irreversible process
  - (B) reversible process
  - (C) isothermal process
  - (D) None of the above

87. The synchronous speed of a 3-phase induction motor having 12 poles and running on 50 Hz supply is
- (A) 1200 r.p.m.
  - (B) 1000 r.p.m.
  - (C) 800 r.p.m.
  - (D) 500 r.p.m.
88. A liquid has surface tension  $\sigma$ . The minimum work required to divide a spherical drop of this liquid of radius  $t$  into 8 equal-sized spherical drops is
- (A)  $\pi t^2 \sigma$
  - (B)  $2\pi t^2 \sigma$
  - (C)  $4\pi t^2 \sigma$
  - (D)  $8\pi t^2 \sigma$
89. A metal block of heat capacity 1 J/K is cooled from 600 K to 300 K by placing it in a large heat reservoir at 300 K. The entropy change of the universe in this process is
- (A) -0.693 J/K
  - (B) 1 J/K
  - (C) -1.693 J/K
  - (D) 0.307 J/K
90. A frictionless piston slowly compresses a gas in an adiabatic cylinder. The entropy change will be
- (A) greater than zero
  - (B) less than zero
  - (C) equal to zero
  - (D) None of the above

~~Handwritten scribbles and calculations~~

$n = \frac{60 \times P}{f}$   
 $\rightarrow \frac{60 \times 12}{50}$

$4\pi\sigma \left[ \frac{4\pi r^2}{4} - \pi r^2 \right]$   
 $4\pi\sigma \left[ \frac{3t^2}{4} - t^2 \right]$   
 $4\pi\sigma \left[ \frac{3t^2 - 4t^2}{4} \right]$   
 $4\pi\sigma \left[ -\frac{t^2}{4} \right]$   
 $W = \sigma \Delta A$   
 $\Rightarrow 4\pi\sigma \left[ \frac{3t^2 - 4t^2}{4} \right]$

$f = \frac{Q}{P}$

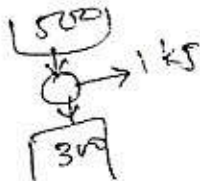
$f = \frac{300}{P}$

$\eta = 1 - \frac{3}{5} = \frac{2}{5}$

$Q = \frac{W}{\eta}$

91. A heat engine operates between 500 K and 300 K. The minimum heat absorption from the source for every kilojoule of work is

- (A) 1.5 kJ
- (B) 1.7 kJ
- (C) 2.5 kJ
- (D) 3 kJ



94.  $q-w$  is a

- (A) path function
  - (B) state function
  - (C) path as well as state function
  - (D) None of the above
- (where  $q$  is specific heat transfer and  $w$  is specific work done)

92. A refrigerator maintains a temperature of 270 K in a room at 300 K. If heat is removed from the interior at a rate of  $900 \text{ J sec}^{-1}$  and the refrigerator operates at 50% of its maximum thermal efficiency, the power requirement is

- (A) 100 W
- (B) 150 W
- (C) 200 W
- (D) 250 W



95. Amorphous glass is expected to have zero value of entropy at 0 K. The statement is

- (A) true
- (B) false
- (C) true if it is in the powder form
- (D) None of the above

93. Liquid water at 1 atmosphere and  $0^\circ\text{C}$ , freezes to ice, transferring heat to the surroundings, also at  $0^\circ\text{C}$ . In this process

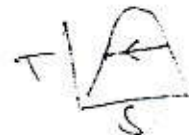
- (A) the entropy of the water decreases, but that of the universe increases
- (B) the entropy of water decreases, but that of the universe remains constant
- (C) the entropy of the water as well as that of the universe increase
- (D) the entropy of the water increases, but that of the universe decreases



$\eta_R = \frac{270}{300} = \frac{9}{10}$   
 $\eta = \frac{1}{2} \Rightarrow \frac{9}{10} = \frac{1}{2}$   
 $\eta = \frac{480}{980}$   
 (d) 20 W

96. The efficiency of a reversible engine is maximum and depends only on the temperature of the source and the sink. The statement is

- (A) correct
- (B) wrong
- (C) uncertain
- (D) correct if it is irreversible process



97. Heat and work are examples of

- (A) thermodynamic properties
- (B) states of thermodynamic systems
- (C) mode of energy transfer
- (D) None of the above

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13

$\frac{4}{3}\pi r^3 = \frac{4}{3}\pi R^3 \times 2^3$   
 $r = \frac{R}{2}$

$C_p = 1 \text{ KJ/K}$   
 $\Delta S = \dots - 1 \ln\left(\frac{1}{2}\right) + \dots$

(P.T.O)



$4\pi r^2 = [nr^2 - R^2]$   
 $\left[8 \times \frac{r^2}{4} - r^2\right]$

27

98. For an ideal gas, compressibility factor should be

- (A) 0
- (B) 1
- (C) -1
- (D) close to 10



102. In case of PERT, if most pessimistic, optimistic and likely time are 10, 2 and 8 days respectively, then the expected duration and variance are

- (A) 8 and  $4/3$
- (B)  $20/3$  and  $16/9$
- (C)  $7.33$  and  $16/9$
- (D)  $7.67$  and  $20/3$

99. The method which follows deterministic approach is

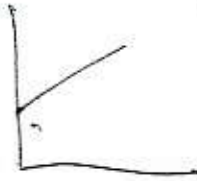
- (A) CPM
- (B) PERT
- (C) both PERT and CPM
- (D) None of the above

103. In case of cash-flow monitoring, it is recommended to draw

- (A) histogram
- (B) cumulative diagram
- (C) bar chart
- (D) homograph

100. Direct cost of an activity

- (A) increases with increase in duration
- (B) decreases with increase in duration
- (C) remains same
- (D) Nothing can be said



104. The total cost of a building is ₹ 3,00,000. The depreciated cost of the building after 30 years, if the life span is 90 years and scrap value is ₹ 30,000, will be (by declining balance method)

- (A) ₹ 2,10,000
- (B) ₹ 1,39,504
- (C) ₹ 1,75,254
- (D) ₹ 2,50,000

101. Mean, median and the mode for the set of values—10, 9, 8, 10, 12, 9, 9, 10, 11, 14 and 8 are

- (A) 10, 8, 14
- (B) 10, 9, 9
- (C) 9, 10, 8
- (D) 11, 9, 8

Median

10

105. An owner has installed an air conditioner at the cost of ₹ 18,000. If the life of the conditioner is 18 years, the coefficient of sinking fund (rate of interest is 5%) is

- (A) 0.055
- (B) 0.0355
- (C) 640
- (D) 1.20

8, 8, 9, 9, 9, 10, 10, 10, 10, 11, 12  
16 + 27 + 30 + 37

$$\frac{4p + 4q + 4r}{8} \cdot \frac{10 + 4 \times 8 + 2}{8}$$

$$\frac{41}{6} \quad \frac{22}{3} \quad \frac{7+3}{5} = \frac{10}{5} = 2$$

106. The average life of Class I timber is  
 (A) 60 months  
 (B) 90 months  
 (C) 120 months  
 (D) 150 months
110. The ingredient which imparts hardness and colour to cement is  
 (A) alkali  
 (B) alumina  
 (C) magnesia  
 (D) sulphur

107. A good stone should have water absorption less than  
 (A) 0.4  
 (B) 0.6  
 (C) 0.8  
 (D) 0.9
111. The compressive strength of the brick should **not** be less than  
 (A) 3.5 MPa  
 (B) 5 MPa  
 (C) 15 MPa  
 (D) 20 MPa

108. The minimum crushing strength of brick should be  
 (A) 35 kg/cm<sup>2</sup>  
 (B) 50 kg/cm<sup>2</sup>  
 (C) 15 kg/cm<sup>2</sup>  
 (D) 20 kg/cm<sup>2</sup>
112. Which one of the following is responsible for red colour of brick?  
 (A) Iron oxide  
 (B) Magnesia  
 (C) Silica  
 (D) Alumina

109. The proportion of cement mortar used for 1 and 2 storeyed structure is  
 (A) 1:2  
 (B) 1:3  
 (C) 1:6  
 (D) 1:1:2
113. Enamel paint is prepared by adding  
 (A) white lead or zinc  
 (B) alumina and zinc  
 (C) magnesia and alumina  
 (D) white lead and alumina

$$\frac{4.12}{37} \quad \frac{1.4}{1} \quad \frac{710}{1} = 10$$

114. Pigments are added to
- (A) give colour to paint
  - (B) reduce the cost of the paint
  - (C) hold the ingredients of the paint
  - (D) make the paint thinner

115. The base material of distemper is
- (A) iron oxide
  - (B) lithopone
  - (C) chalk
  - (D) lime

116. In industrial building, hard wearing surface can be achieved by
- (A) terrazzo flooring
  - (B) granolithic flooring
  - (C) mosaic flooring
  - (D) tiled flooring

117. Which one of the following is **not** true with respect to ribbed tiled floors?
- (A) Light in weight
  - (B) Better soundproofing qualities
  - (C) Poor fire resistance
  - (D) Better thermal insulation

118. Plywood is identified by
- (A) thickness
  - (B) volume
  - (C) area
  - (D) weight

119. It is required to produce a small-scale map of an area in a magnetic zone by directly plotting and checking the work in the field itself. Which one of the following surveys will be most appropriate for this purpose?
- (A) Chain
  - (B) Theodolite
  - (C) Plane table
  - (D) Compass

120. The technique of plotting all the accessible stations with a single setup of plane table is called
- (A) radiation
  - (B) intersection
  - (C) resection
  - (D) traversing

121. A 30 m chain is found to be 0.1 m short throughout the measurement. If the distance measured is recorded as 300 m, then the actual distance will be
- (A) 300.1 m
  - (B) 301.0 m
  - (C) 299 m
  - (D) 310.0 m

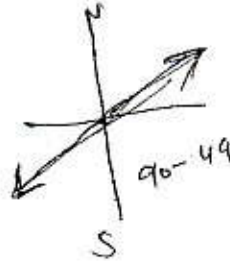


122. Offsets are

- (A) lateral measurements made with respect to main survey lines
- (B) perpendicular erected from chain lines
- (C) taken to avoid unnecessary walking between stations
- (D) measurements which are not made at right angles to the chain line

123. If fore-bearing of a line is  $S49^{\circ}52'E$ , then the back bearing will be

- (A)  $S49^{\circ}52'E$
- (B)  $S52^{\circ}49'E$
- (C)  $N49^{\circ}08'E$
- (D)  $N49^{\circ}52'W$



124. In a parabolic vertical curve, the rising grade  $g_1 = +0.8\%$  and the falling gradient  $g_2 = -0.7\%$ . The rate of change of grade is 0.05 per chain. The length of the vertical curve is

- (A) 30 chains
- (B) 40 chains
- (C) 50 chains
- (D) 60 chains

125. An angle measuring instrument reading up to one-sixth of a degree on the main scale is equipped with a vernier having 19 main scale divisions divided into 20 parts. The correct least count for the instrument is

- (A) 60 seconds
- (B) 30 seconds
- (C) 20 seconds
- (D) 10 seconds

126. For a simple circular curve, which one of the following gives the correct relation between the radius  $R$  and degree of curve  $D$ , for 20 m arc length?

- (A)  $R = 5729.6 / D$
- (B)  $R = 1718.9 / D$
- (C)  $R = 1145.9 / D$
- (D)  $R = 572.9 / D$

127. The radius of curvature of an ideal transition curve should be

- (A) inversely proportional to its length
- (B) directly proportional to its length
- (C) proportional to speed of vehicle
- (D) proportional to super-elevation

128. If the difference of height between two points is 1 m and the slope distance between them is 100 m, then the accuracy of slope correction determination could be 1 in 100000 provided the heights are measured with an accuracy of

- (A)  $\pm 0.1$  cm
- (B)  $\pm 0.5$  cm
- (C)  $\pm 1.0$  cm
- (D)  $\pm 5.0$  cm

129. A and B are two traverse stations free from local attraction errors. If the true bearing of a line AB is  $89^\circ$  and the magnetic declination at point A is  $1^\circ$  west, then the magnetic bearing of line BA would be

- (A)  $88^\circ$
- (B)  $90^\circ$
- (C)  $268^\circ$
- (D)  $270^\circ$

130. Which one of the following gives the correct distance between the lighthouse and a ship, when the lighthouse whose height is 100 m is visible just above the horizon from the ship?

- (A) 30.68 km
- (B) 36.50 km
- (C) 38.54 km
- (D) 40.54 km

131. To find the RL of a roof slab of a building, staff readings were taken from a particular setup of the levelling instrument. The readings were 1.050 m with staff on the benchmark and 2.300 m with staff below the roof slab and held inverted. Taking the RL of the BM as 135.150 m, the RL of the roof slab will be

- (A) 129.800
- (B) 131.900
- (C) 134.400
- (D) 138.500

132. For the scale of plotting 1 in 400, the permissible error in centring of plane table is about

- (A) 0.5 m
- (B) 0.3 m
- (C) 0.1 m
- (D) 0.01 m

133. Ceylon Ghat Tracer is used to measure

- (A) slope
- (B) reduced levels
- (C) distances
- (D) depth of sea

134. BOD test is standardized at

- (A)  $10^\circ\text{C}$  and 10 days
- (B)  $20^\circ\text{C}$  and 5 days
- (C)  $37^\circ\text{C}$  and 3 days
- (D)  $50^\circ\text{C}$  and 2 days

135. Absolutely soft waters are required for

- (A) drinking
- (B) boilers
- (C) washing with synthetic detergent soap
- (D) prevention of corrosion in pipe

136. Permanent hardness of water is because of

- (A)  $\text{CaHCO}_3$
- (B)  $\text{NaHCO}_3$
- (C)  $\text{MgHCO}_3$
- (D)  $\text{CaSO}_4$

137. Zeolite process is used

- (A) for disinfection of water
- (B) for colour removal from water
- (C) for water softening
- (D) for turbidity removal

138. Blue baby disease results with

- (A) high fluoride content in water
- (B) high nitrate content in water
- (C) high chloride content in water
- (D) high iron content in water

139. The major constituent which causes alkalinity in water is

- (A) dissolved  $\text{O}_2$
- (B) dissolved  $\text{NH}_3$   $\text{NH}_3 + \text{H}_2\text{O}$
- (C) dissolved  $\text{CO}_2$
- (D) All of the above

140. Sedimentation process is based on which of the following physical laws?

- (A) Newton's third law
- (B) Conservation of mass
- (C) Stokes' law
- (D) Conservation of energy

141. Fine sand is used as media in case of

- (A) slow sand filter
- (B) rapid sand filter
- (C) pressure filter
- (D) All of the above

142. Sullage is

- (A) waste water from baths
- (B) drainage from road
- (C) industrial liquid waste
- (D) All of the above

143. The end product of decomposed organic matter is  
 (A)  $\text{CO}_2$   
 (B)  $\text{H}_2\text{S}$   
 (C)  $\text{NO}_3$   
 (D)  $\text{NH}_3$
144. Grit is  
 (A) inert matter of specific gravity  $> 2.65$   
 (B) organic matter of specific gravity 1  
 (C) organic and inert matter combined  
 (D) colloidal matter of heavy specific gravity
145. Activated sludge process is a biological process involving  
 (A) aerobic + anaerobic bacteria  
 (B) aerobic bacteria + protozoa + algae  
 (C) anaerobic bacteria + fungi  
 (D) facultative bacteria + algae
146. Sludge digestion is  
 (A) disposal of sludge  
 (B) dilution of sludge  
 (C) stabilization of sludge  
 (D) removal of sludge from waste
147. Anaerobic sludge digestion mainly yields  
 (A) methane  
 (B) ammonia  
 (C) Both (A) and (B)  
 (D) None of the above
148. Self-purification of water body is mainly due to  
 (A) dissolved  $\text{O}_2$   
 (B) dissolved  $\text{NO}_3$   
 (C) Both (A) and (B)  
 (D) None of the above
149. When bleaching powder is added to water, its pH value  
 (A) increases  
 (B) decreases  
 (C) remains unaffected  
 (D) depends on characteristics of water
150. If the total hardness of water is greater than its alkalinity, the carbonate hardness will be equal to  
 (A) total alkalinity  
 (B) total hardness  
 (C) total hardness - total alkalinity  
 (D) non-carbonate hardness