(*b*) labour policy
(*c*) capital investment policy
(*d*) material procurement policy
(*e*) all of the above.

16.225. The reliability of a product can be increased by
(*a*) derating
(*b*) crossing infant stage
(*c*) conducting life test on each part
(*d*) employing burn in tests
(*e*) decreasing acceptable life.

16.226. Input output analysis is processed through
(*a*) time and motion study
(*b*) work study
(*c*) value analysis
(*d*) product analysis
(*e*) transaction matrix.

16.227. Salvaging means
(*a*) writing off the assets
(*b*) adjusting losses against assets
(*c*) mortgaging property
(*d*) disposing off property which is no longer useful in present situation
(*e*) disposing off property in as such condition.

16.228. Amortization means
(*a*) liquidation of financial obligations
(*b*) liquidation of an industry
(*c*) commitment of financial obligations
(*d*) liquidation of financial obligations on instalment basis
(*e*) payments on instalment basis.

16.229. The most flexible criteria for analysing an economic investment is
(*a*) present value method
(*b*) future value method
(*c*) salvage value
(*d*) rate of return criteria
(*e*) benefit cost ratio analysis.

16.230. The shadow prices
(*a*) include taxes and subsidy
(*b*) include taxes and not subsidy
(*c*) include subsidy and not taxes
(*d*) do not include taxes and subsidy
(*e*) none of the above.

16.231. If λ be the failure rate in failures per hour, then its unreliability is given by
(*a*) $e^{-\lambda t}$ (*b*) $\lambda e^{-\lambda t}$
(*c*) $1-e^{-\lambda t}$ (*d*) $\dfrac{1-e^{-\lambda t}}{e^{-\lambda t}}$
(*e*) $\dfrac{1+e^{-\lambda t}}{e^{-\lambda t}}$.

16.232. A system comprises of two components in parallel, one working and other standby, each having failure rate of λ failures per hour. The reliability of system is
(*a*) $e^{-2\lambda t}$ (*b*) $1-e^{-2\lambda t}$
(*c*) $(1-e^{-\lambda t})^2$ (*d*) $1-(1-e^{-\lambda t})^2$
(*e*) $\dfrac{1+e^{-2\lambda t}}{e^{-2\lambda t}}$

16.233. In works management, theory of transactional analysis (TA) is applied to determine the
(*a*) feasibility of project
(*b*) cause of behaviour of personnel
(*c*) time taken for each activity
(*d*) best layout
(*e*) optimum returns from a project.

16.234. As per behavioural science, culture of a person (or a script of a person or his reaction of stimulus) depends upon his
(*a*) heridetary
(*b*) early brought up, training, education and development
(*c*) society he keeps
(*d*) own experience of life
(*e*) all of the above.

16.235. Free trade zone means trade between
(*a*) two countries without tariff
(*b*) two manufacturers without tax liability
(*c*) manufacturer and consumer
(*d*) manufacturer and wholesaler
(*e*) two traders.

16.236. For effective utilisation of manpower it is essential to understand the need of a man to satisfy them. The need of a person is
(*a*) job satisfaction
(*b*) make both ends meet
(*c*) ego satisfaction (self respect) and self actualisation
(*d*) job security
(*e*) all of the above.

16.237. The important criterion for successful works management is

(*a*) select right men and establish objectivity
(*b*) create right team work (coordination of job responsibility)
(*c*) watch professional activities through scientific feedback
(*d*) watch results and take corrective actions
(*e*) all of the above.

16.238. MIS stands for
(*a*) military inspection scheme
(*b*) management information system
(*c*) management intelligence system
(*d*) management information service
(*e*) none of the above.

16.239. According to Pareto principle, an effective man is one who
(*a*) can manage his boss
(*b*) can manage his subordinates
(*c*) can manage his colleagues
(*d*) all of the above
(*e*) pick up vital from the trivial many things.

16.240. Gross national product means
(*a*) total earning of all citizens
(*b*) total taxes paid
(*c*) expenditure by government
(*d*) total value of goods produced in a country
(*e*) total value of gold existing in a country.

16.241. The first free trade zone in India was established at
(*a*) Cochin (*b*) Goa
(*c*) Madras (*d*) Bombay
(*e*) Delhi.

17

General Engineering

MATHEMATICS

17.1. The sum of the frequencies prior to a particular class is called
(*a*) mean (*b*) mode
(*c*) medium
(*d*) cumulative frequency
(*e*) standard frequency.

17.2. The curvature of a circle at any point is
(*a*) 90° (*b*) 180°
(*c*) 360°
(*d*) reciprocal of its radius
(*e*) reciprocal of its diameter.

17.3. Two non-zero vectors are parallel if their vector product is
(*a*) 1 (*b*) 0
(*c*) ∞ (*d*) − 1
(*e*) − ∞.

17.4. The parametric equations $x = a \sec \theta$ and $y = a \tan \theta$ are for
(*a*) circle (*b*) parabola
(*c*) hyperbola (*d*) ellipse
(*e*) cylinder.

17.5. A monotonic sequence is convergent if it is
(*a*) increasing to infinity
(*b*) decreasing to infinity
(*c*) bounded (*d*) unbounded
(*e*) real.

17.6. The value of $\int \frac{x}{\cos^2 x}$ is equal to
(*a*) $x \tan x$ (*b*) $\log \cos x$
(*c*) $x \tan x + \log \cos x$
(*d*) $x \tan x - \log \cos x$
(*e*) $\log \cos x - x \tan x$.

17.7. The value of $\underset{x \to \infty}{\text{Lt}} \frac{\sin x}{x}$ is equal to
(*a*) 1 (*b*) − 1
(*c*) zero (*d*) infinity
(*e*) none of the above.

17.8. $\underset{x \to \infty}{\text{Lt}} \left(\frac{x^2 - 8}{x^2 - 4}\right)$ is equal to
(*a*) 0 (*b*) 1
(*c*) 2 (*d*) 3
(*e*) − 3.

17.9. The series $\sum \frac{r^n}{\underline{n}}$ is convergent absolutely for the following value of r
(*a*) all real values
(*b*) all imaginary values
(*c*) all complex values
(*d*) $r \geq 0$
(*e*) $r \leq 0$.

17.10. The series $\sum \frac{1}{n^{p-1}}$ is convergent if p is
(*a*) $\angle - 1$ (*b*) $= -\infty$
(*c*) $= 0$ (*d*) > 0
(*e*) < 0.

17.11. The series $\Sigma (\sqrt{n^3 + 1} - \sqrt{n^3 - 1})$ is
(*a*) divergent to $+\infty$
(*b*) divergent to $-\infty$
(*c*) convergent (*d*) oscillatory
(*e*) none of the above.

17.12. The function $e^{1/z}$ has an essential isolated singularity at z and it is equal to
(*a*) 0 (*b*) 1
(*c*) − 1 (*d*) ∞
(*e*) none of the above.

17.13. If $f(x)=\frac{1-x}{1+x}$, then $f\left(\frac{1}{x}\right)$ is equal to
(a) $f(x)$ (b) $-f(x)$
(c) $f(-x)$ (d) $\pm f(x)$
(e) $f(\pm x)$.

17.14. The rank of the following matrix $\begin{bmatrix}1 & 1 & 0\\1 & 1 & 0\\1 & 1 & 0\end{bmatrix}$ is
(a) 0 (b) 1
(c) 2 (d) 3
(e) none of the above.

17.15. Inverse Laplace transform of $\frac{S}{S^2+a^2}$ is
(a) $\frac{e^{at}+e^{-at}}{2}$ (b) $\frac{e^{at}-e^{-at}}{2}$
(c) $\frac{e^{at}}{2}$ (d) $\frac{e^{-at}}{2}$
(e) $\frac{e^{at}+e^{-at}}{e^{at}}$.

17.16. The inverse Laplace transform of $\frac{1}{(S-a)(S-b)}$ is equal to
(a) $\frac{e^{at}+e^{bt}}{a-b}$ (b) $\frac{e^{at}-e^{bt}}{a+b}$
(c) $\frac{e^{(a+b)}}{a+b}$ (d) $\frac{e^{at}-e^{bt}}{a-b}$
(e) $\frac{e^{-at}-e^{-bt}}{a-b}$.

17.17. If $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ are zero at some point for the function $y=f(x)$, but $\frac{d^3y}{dx^3}$ is not zero, then the point is said to be a point of
(a) maxima (b) minima
(c) inflexion
(d) uniform curvature
(e) contraflexure.

17.18. If $x=a(\theta-\sin\theta)$ and $y=a(1-\cos\theta)$ then $\frac{dy}{dx}$ is equal to
(a) cos θ/2 (b) sin θ/2
(c) tan θ/2 (d) cot θ/2
(e) cosec θ/2.

17.19. The number of degrees in Legendere's Polynomial $P_n(x)$ is equal to
(a) n (b) $n+1$
(c) $n-1$ (d) $2n-1$
(e) $2n+1$.

17.20. If 'a' is to be eliminated from the relation $y=ax+x^2$, then the differential equation will be of the form
(a) $y=x\frac{dy}{dx}+\left(\frac{dy}{dx}\right)^2$
(b) $y=\frac{dy}{dx}+x\left(\frac{dy}{dx}\right)^2$
(c) $y=x+\frac{dy}{dx}$
(d) $y=\left(\frac{dy}{dx}\right)^2+x$
(e) $y=\frac{d^2y}{dx^2}+x\frac{dy}{dx}$.

17.21. The minimum value of the function $y=x^5-4x^4+5x^3-1$ will occur when the value of x is equal to
(a) 0 (b) 1
(c) 2 (d) 3
(e) 4.

17.22. If A and B are non-singular matrices of the same order, then $(AB)^{-1}$ is equal to
(a) $A^{-1}B^{-1}$ (b) $B^{-1}A^{-1}$
(c) AB^{-1} (d) $A^{-1}B$
(e) AB.

CHEMISTRY

17.23. Ionic reactions generally occur in
(a) gas phase
(b) liquid phase
(c) non-polar solvents
(d) solution in polar solvents
(e) all of the above.

17.24. Sensitive emulsion on photographic films is made of
(a) silver nitrate
(b) mercuric bromide
(c) hydrogen bromide
(d) silver bromide
(e) silver fluoride.

17.25. The phenomenon of the passage of the solvent into a solution through a semi permeable membrane is called
(a) osmosis (b) reverse osmosis

(c) diffusion (d) filteration
(e) clarifloculation.

17.26. A solution that can resist change in its pH on addition of alkali/acid is called
(a) neutral solution
(b) ideal solution
(c) zero pH solution
(d) buffer solution
(e) active solution.

17.27. Natural rubber is polymer of
(a) isobutane (b) isoprene
(c) propane (d) isopropene
(e) ethylene.

17.28. Select visco-elastic material
(a) glass (b) silica
(c) nylon (d) rubber
(e) wood.

17.29. Select the heterogeneous system
(a) mixture of gases in atmosphere
(b) medium inside a cooker
(c) medium inside a furnace
(d) mixture of ice and water
(e) mixture of ice, water and steam.

17.30. The pH value of 0.01 N HCl solution is
(a) 1 (b) 2
(c) 4 (d) 6
(e) 10.

17.31. Which of the following is used for sterilisation of water
(a) chlorine
(b) oxygen
(c) hydrogen sulphide
(d) ozone
(e) carbon dioxide.

17.32. Which of the following acids is used for etching of glass
(a) hydrochloric acid
(b) hydrofluoric acid
(c) hydrobromic acid
(d) sulphuric acid
(e) nitric acid.

17.33. The structure of polyethylene is
(a) triclinic (b) hexagonal
(c) mono clinic
(d) ortho rhombic (e) prismatic.

17.34. The passage of current in an electrolyte is due to movement of
(a) electrons (b) particles
(c) molecules (d) atoms
(e) ions.

17.35. Which of the following has least hardness
(a) diamond (b) topaz
(c) quartz (d) talc
(e) silicon carbide.

17.36. Visco elastic behaviour is observed in
(a) crystalline materials
(b) non-crystalline materials
(c) rubber
(d) shellac
(e) non-crystalline organic polymers.

17.37. Which of the following material would have maximum magnetic permeability
(a) pure iron (b) cast iron
(c) mild steel (d) Fe_3C
(e) 4% silicon steel.

17.38. Which of the following phosphorous is used as poison
(a) black (b) red
(c) white (d) violet
(e) green.

17.39. An aquous solution of Na_2CO_3 will be
(a) acidic (b) basic
(c) neutral (a) turbid
(e) none of the above.

17.40. Solution of sodium hydroxide conducts electricity because it is
(a) a good conductor
(b) a basic solution
(c) a weak electrolyte
(d) a strong electrolyte
(e) an electrolyte.

17.41. The number of degrees of freedom for monoatomic gas is
(a) 0 (b) 1
(c) 2 (d) 3
(e) 4.

PHYSICS

17.42. Loudness of sound is function of
(a) frequency (b) amplitude
(c) speed of propagation
(d) pitch (e) ripple factor.

17.43. The path of an electron in a uniform electric field is
(a) straight (b) parabolic

(*c*) circular (*d*) elliptical
(*e*) helical.

17.44. The frequency of transverse vibration of a stretched string is proportional to
(*a*) tension (*b*) $\sqrt{\text{tension}}$
(*c*) tension^2 (*d*) $\frac{1}{\text{tension}}$
(*e*) $\frac{1}{\sqrt{\text{tension}}}$.

17.45. Sea water as compared to distilled water will boil at
(*a*) same temperature
(*b*) higher temperature
(*c*) lower temperature
(*d*) higher/lower depending on pH value
(*e*) unpredictable.

17.46. Which of the following is the heaviest
(*a*) electron (*b*) neutron
(*c*) proton (*d*) neucleus
(*e*) atom.

17.47. The refractive index is highest for the following element
(*a*) diamond (*b*) water (distilled)
(*c*) glass (*d*) kerosene oil
(*e*) water (sea).

17.48. Cathode rays have particle nature is proved by the fact that they
(*a*) produce fluorescence
(*b*) travel in straight line
(*c*) get deflected by electric and magnetic fields
(*d*) carry current
(*e*) result in increase of temperature wherever they fall.

17.49. Metals attain super-conduction properties below the temperature of
(*a*) 0°C (*b*) 100°C
(*c*) 100°K (*d*) 10°K
(*e*) 0°K.

17.50. A watch working on an oscillating spring, if taken to moon
(*a*) will slow down
(*b*) run fast
(*c*) stop working
(*d*) give same time
(*e*) require adjustments.

17.51. A real gas as compared to an ideal gas at very high pressure occupies
(*a*) less volume (*b*) more volume
(*c*) same volume
(*d*) more/less depending on gas
(*e*) unpredictable.

17.52. If a bottle containing water and air is tied by a string at its neck and whirled in a horizontal circle, then air bubbles will
(*a*) move towards bottom
(*b*) move towards middle
(*c*) get distributed throughout
(*d*) move towards neck
(*e*) take position in bottle depending on speed of bottle.

17.53. Same mass is first dropped from a certain height vertically downwards and then rolled down on a smooth inclined plane from same height. The work done in rolling down the plane compared to falling vertically down will be
(*a*) more (*b*) less
(*c*) same
(*d*) more/less depending on mass of body
(*e*) unpredictable.

17.54. Which of the following is the bigger quantum of pressure
(*a*) 1 kg/cm^2 (*b*) 1 inch of mercury
(*c*) 1 m of water column
(*d*) 1 pound/sq inch
(*e*) 1 kg/mm^2.

17.55. One torr is equivalent to
(*a*) 1 mm Hg (*b*) 1 mm water
(*c*) 1 kg/cm^2
(*d*) 1 atmospheric pressure
(*e*) 1 kg/m^2.

17.56. 100 calories heat is equivalent to following work
(*a*) 418 ergs (*b*) 418 watts
(*c*) 418 joules
(*d*) 418 dynes (*e*) 418 kg m.

17.57. In order to double the period of oscillation of a pendulum, its length should be
(*a*) doubled (*b*) quadrupled
(*c*) 1/doubled (*d*) 1/quadrupled
(*e*) none of the above.

17.58. The oil in the wick rises up in an oil lamp by the property of
(*a*) capilarity (*b*) surface tension
(*c*) buoyancy (*d*) viscosity
(*e*) temperature difference.

17.59. The product of pressure and volume of a fixed amount of gas is constant is known as
(*a*) gas law (*b*) Charle's law
(*c*) Dalton's law (*d*) Avagadro's law
(*e*) none of the above.

17.60. The weight of 1 cubic metre of air would be around
(*a*) 13 gm (*b*) 130 gm
(*c*) 1300 gm (*d*) 13000 gm
(*e*) none of the above.

17.61. For photography through mist, following photographic film is used
(*a*) X-ray (*b*) infra red
(*c*) ultra violet (*d*) sodium coated
(*e*) polaroid.

17.62. Powder clinges to skin because of following property
(*a*) adhesion (*b*) cohesion
(*c*) surface tension
(*d*) capillary action
(*e*) pressure difference.

17.63. The velocity vector in SHM w.r.t. displacement vector
(*a*) is in phase (*b*) leads by 90°
(*c*) lags by 90° (*d*) leads by 180°
(*e*) lags by 180°.

17.64. Crystal structure of a material can be examined by
(*a*) tool room microscope
(*b*) optical microscope
(*c*) electron microscope
(*d*) X-ray and electron diffraction
(*e*) gamma radiology.

17.65. When a ray of light enters from one medium to another separated by a sharp boundary, the following parameter does not change
(*a*) frequency (*b*) velocity
(*c*) wavelength (*d*) intensity
(*e*) none of the above.

17.66. As the temperature of medium increases, the velocity of sound through it will increase. The velocity of sound bocomes 1.5 times the velocity at 7°C at the following temperature
(*a*) 157°C (*b*) 257°C
(*c*) 343°C (*d*) 357°C
(*e*) 457°C.

17.67. Which of the following quantities has no dimension
(*a*) specific weight
(*b*) specific humidity
(*c*) specific heat
(*d*) specific gravity
(*e*) specific conductivity.

17.68. Isotopes of an element have same chemical properties but different
(*a*) atomic mass (*b*) atomic number
(*c*) atomic mass and different atomic number
(*d*) identical atomic mass and atomic number
(*e*) none of the above.

17.69. The loudness of a sound depends upon
(*a*) frequency (*b*) pitch
(*c*) speed (*d*) amplitude
(*e*) all of the above.

17.70. Density of water is maximum at
(*a*) 0°C (*b*) 4°C
(*c*) 20°C (*d*) 96°C
(*e*) 100°C.

17.71. Aneroid barometer contains following liquid
(*a*) water (*b*) acetone
(*c*) mercury (*d*) alcohol
(*e*) no liquid.

17.72. Which of the following is the unit of pressure
(*a*) kg/m sec^2 (*b*) kg/m sec
(*c*) kg/m^2 sec (*d*) kg/m^2 sec^2
(*e*) kg/m sec^2.

17.73. Cadmium rods in a nuclear reactor are used to
(*a*) slow down neutrons
(*b*) absorb neutrons
(*c*) speed up neutrons
(*d*) initiate chain reaction
(*e*) not used at all.

17.74. A bucket of water is lying on a spring balance. An iron piece is suspended from an independent support in water without touching any part of the bucket. The balance reading will
(*a*) increase (*b*) decrease
(*c*) remain unchanged
(*d*) may increase/decrease depending on weight of iron piece

(*e*) unpredictable.

17.75. The direction of movement of molecules in a solid is
(*a*) haphazard (*b*) cyclic
(*c*) helical (*d*) circular
(*e*) back and forth like tiny pendulums.

17.76. It is easier to swim in sea water than in pool because
(*a*) sea water is available in plenty
(*b*) of waves in sea
(*c*) waves carry man on shore
(*d*) sea water has more density than tap water in pool
(*e*) of higher depth.

17.77. One cubic centimetre of metal would contain the number of atoms of the following order
(*a*) 10^5 (*b*) 10^{12}
(*c*) 10^{18} (*d*) 10^{22}
(*e*) 10^{52}.

17.78. Which of the following rays has the lowest wavelength
(*a*) radio waves (*b*) X-rays
(*c*) infra red rays (*d*) ultraviolet rays
(*e*) ultrasonic waves.

17.79. The atomic number of carbon is 12. It means that carbon atom contains
(*a*) 6 protons and 6 electrons
(*b*) 12 neutrons
(*c*) 12 electrons
(*d*) 12 protons
(*e*) 12 protons and 12 electrons.

17.80. Vacuum tubes utilise following method of electron emission
(*a*) mechanical
(*b*) magnetic field
(*c*) electrical field
(*d*) thermionic
(*e*) secondary.

17.81. Vacuum tubes employ following type of electron emission
(*a*) solid state emission
(*b*) high electric field emission
(*c*) secondary emission
(*d*) thermionic emission
(*e*) mechanical emission.

17.82. The *p-n* junction behaves like a
(*a*) diode (*b*) triode
(*c*) tetrode (*d*) pentode
(*d*) any one of the above.

17.83. In the case of PNP transistor
(*a*) emitter is positive w.r.t. base
(*b*) base is negative w.r.t. collector
(*c*) collector is positive w.r.t. emitter
(*d*) collector is positive w.r.t. base
(*e*) none of the above.

17.84. Which is correct statement for a NPN transistor
(*a*) collector is negative w.r.t. base
(*b*) collector is negative w.r.t. emitter
(*c*) base is negative w.r.t. emitter
(*d*) base is negative w.r.t. collector and positive w.r.t. emitter
(*e*) none of the above.

17.85. For NPN transistor, negative voltage is required at
(*a*) base (*b*) collector
(*c*) emitter
(*d*) base and emitter
(*e*) base and collector.

17.86. Transistor inter-junction capacitance causes following in the amplifiers
(*a*) noise (*b*) harmonic distortion
(*c*) phase shift (*d*) parasitic oscillations
(*e*) reduction of gain.

17.87. Large scale integrated (LSI) chips have more than following number of logic gates on a single chip
(*a*) 10 (*b*) 25
(*c*) 50 (*d*) 150
(*e*) 1000.

17.88. The specific conductivity of semi conductors is of the order of
(*a*) 1 ohm/cm (*b*) 10^{-1} ohm/cm
(*c*) 10^{-3} ohm/cm (*d*) 10^{-6} ohm/cm
(*e*) 10^{-9} ohm/cm.

17.89. When moving electrons strike a target of high atomic weight, they result in production of
(*a*) X-rays (*b*) α-rays
(*c*) γ-rays (*d*) β-rays
(*e*) mixture of all of the above.

17.90. The function of modulation is to
(*a*) multiplex a number of signals
(*b*) transmit information over long distances

(c) reduce the band width requirements
(d) enable use of antenna of appropriate height
(e) reduce noise.

17.91. The phase shift between input and output in case of a collector-emitter connected transistor is
(a) 0° (b) 45°
(c) 90° (d) 180°
(e) 270°.

17.92. The maximum contribution to noise in case of radio receiver is due to
(a) power supply (b) modulation stage
(c) mixer stage (d) antenna
(e) power amplifier stage.

17.93. The VTVM can be used to measure
(a) d.c. voltage only
(b) d.c. voltage of high frequency only
(c) d.c. voltage and a.c. voltage upto the order of 5 MHz frequency
(d) a.c. voltage of low frequency
(e) electric power.

17.94. Thyratron is the name given to a
(a) gas filled triode
(b) gas filled pentode
(c) gas filled tubes
(d) vacuum tubes
(e) power transistors.

17.95. Lissajous patterns can be used to determine
(a) power factor
(b) frequency
(c) voltage amplitude
(d) phase shift
(e) noise.

17.96. The figure produced on CRT screen by two waves of the same frequency and amplitude but 90° phase difference will be
(a) circle (b) ellipse
(c) straight line (d) parabola
(e) hyperbola.

17.97. If negative feedback is applied to an amplifier stage, then its
(a) gain stability increases
(b) band width decreases
(c) distortion increases
(d) noise level increases
(e) all of the above.

17.98. DC amplifier is used for amplification of
(a) d.c. signals only
(b) a.c. signals only
(c) modulated signals only
(d) coded signals
(e) both a.c. and d.c. signals.

17.99. Buffer amplifier in RF amplifiers for coupling purpose is used with a view to ensure
(a) minimum loading
(b) minimum dismatch
(c) both of the above
(d) maximum loading and minimum dismatch
(e) compatibility.

17.100. Which of the following amplifier has the largest bandwidth ?
(a) R-C coupled amplifier
(b) transformer coupled amplifier
(c) direct-coupled amplifier
(d) difference amplifier
(e) (a) and (c) above.

17.101. For a common base amplifier, the output voltage as compared to input voltage is
(a) of same magnitude
(b) in phase
(c) out of phase
(d) of lesser magnitude
(e) no correlation.

17.102. The overall gain of the three amplifier stages of 10 gain each will be
(a) 10 (b) $\frac{10}{3}$
(c) 30 (d) 1000
(e) 900.

17.103. Which of the following is the frequency sensitive component
(a) resistor (b) electronic valve
(c) inductor (d) diode
(e) transistor.

17.104. Which of the following displays has minimum power consumption ?
(a) light emitting diode (LED)
(b) liquid crystal display (LCD)
(c) nixie tubes
(d) flourescent
(e) all of the above.

17.105. At resonent frequency the impedance of a parallel connected LCR network is
(a) purely inductive
(b) purely capacitive

(*c*) purely resistive
(*d*) purely reactive
(*e*) complex.

17.106. The impedance at frequencies above resonance frequency is
(*a*) purely inductive
(*b*) purely capacitive
(*c*) purely resistive
(*d*) purely reactive
(*e*) complex.

17.107. Telephone channels occupy frequency range of
(*a*) 0–4000 Hz
(*b*) 100–10,000 Hz
(*c*) 10 kHz–100 kHz
(*d*) any one of the above
(*e*) none of the above.

17.108. Boltmeter is used for measurement of
(*a*) audio power
(*b*) r.f. power
(*c*) microwave power
(*d*) electric power
(*e*) X-ray power.

17.109. Which of the following is a semiconductor
(*a*) carbon (*b*) silica
(*c*) magnesium (*d*) germanium
(*e*) molybdenum.

17.110. A radar measures the distance by measuring the
(*a*) voltage amplitude of the transmitted r.f. pulses
(*b*) voltage amplitude of an echo
(*c*) time between transmitted r.f. pulses
(*d*) time between its r.f. pulse and its echo
(*e*) all of the above.

ELECTRICAL ENGINEERING

17.111. The inductance of a coil can be increased by
(*a*) decreasing number of turns
(*b*) increasing core length
(*c*) using core material of high relative permeability
(*d*) all of the above
(*e*) none of the above.

17.112. The resistance of a lamp rated at 240 V and 60 watts is equal to
(*a*) 60 ohms (*b*) 120 ohms
(*c*) 240 ohms (*d*) 480 ohms
(*e*) 30 ohms.

17.113. Two resistances of 100 ohms and zero ohm are connected in parallel. The overall resistance will be
(*a*) 100 ohms
(*b*) 50 ohms
(*c*) zero ohm
(*d*) any one of the above
(*e*) none of the above.

17.114. A parallel a.c. circuit in resonance will
(*a*) have high impedance
(*b*) generate maximum noise
(*c*) generate maximum heat
(*d*) generate maximum power
(*e*) have pure resistance.

17.115. Two resistors of 2 kohm value each and 1 watt rating are connected in series. The net resistance and wattage value will be
(*a*) 4 k-ohm, 2 watt
(*b*) 1 k-ohm, $\frac{1}{2}$ watt
(*c*) 4 k-ohm, 1 watt
(*d*) 2 k-ohm, 2 watt
(*e*) 2 k-ohm, $\frac{1}{2}$ watt.

17.116. Sheath is used in the cables to
(*a*) prevent the moisture from entering the cable
(*b*) provide the strength to the cable
(*c*) avoid the chances of the rust on the strands
(*d*) provide proper insulation
(*e*) reduce noise pick up.

17.117. The voltage stress is maximum in the cable
(*a*) at the surface of the sheath
(*b*) at the surface of the conductor
(*c*) at the surface of the insulator
(*d*) at the surface of the armouring
(*e*) at the surface of the conductor.

17.118. Which of the following parameter will be more for 16 gauge copper wire in comparison to 14 gauge copper wire
(*a*) cost (*b*) strength
(*c*) resistance (*d*) weight
(*e*) all of the above.

17.119. The length of wire having resistance of 1 ohm/m in a heater rated at 1000 W and 250 V will be

(a) 250 m (b) 125 m
(c) 62.5 m (d) 500 m
(e) 1000 m.

17.120. Power dissipated in a pure capacitor is
(a) minimum (b) maximum
(c) infinite (d) zero
(e) dependent on voltage applied.

17.121. The size of the feeder is determined primarily by
(a) the current it is required to carry
(b) the percentage variation of voltage in the feeder
(c) the voltage across the feeder
(d) the distance over which the transmission is made
(e) the power rating.

17.122. Non-conductors whose polarisation is caused by an electric field are known as
(a) dielectric
(b) super conductors
(c) semi conductors
(d) insulators
(e) semi insulators.

17.123. If the diameter of a conductor is doubled, then its resistance will be reduced to
(a) half (b) one-fourth
(c) one-eight (d) one-sixteenth
(e) $\frac{1}{\sqrt{2}}$ times.

17.124. One of the difficulties encountered with super conductors is
(a) that materials become highly magnetic
(b) strength is reduced
(c) resistance is increased
(d) maintenance of low temperature
(e) hydrogen embrittlement.

17.125. A coil having an inductance of 100 mH is carrying a current of 100 A. If the current is reduced to zero in 0.02 sec. the self induced e.m.f. will be
(a) 125 V (b) 250 V
(c) 375 V (d) 500 V
(e) 750 V.

17.126. Which of the following is the poorest conductor of electricity
(a) silver (b) copper
(c) aluminium (d) carbon
(e) steel.

17.127. A 50 turn coil is linked with a magnetic flux of intensity 0.0004 webers. If the direction of this flux is reversed in 0.01 sec, then the e.m.f. induced in the coil will be
(a) 1 V (b) 2 V
(c) 4 V (d) 9 V
(e) 1/4 V.

17.128. If the potential difference across a parallel plate air capacitor is increased, the electric field intensity between the plates will increase
(a) in same proportion
(b) double the proportion
(c) as square of the change
(d) as square root of the change
(e) first rapidly and then slowly.

17.129. The power factor at resonance in R-L-C parallel circuit is
(a) 0.5 lagging (b) 0.5 leading
(c) unity (d) zero
(e) many have any value.

17.130. A 10 cm long conductor is linked with a magnetic field of 1 weber/sq. m. When a current of 10 A passes through it, it will experience a force of
(a) 0.01 N (b) 0.1 N
(c) 1 N (d) 10 N
(e) 100 N.

17.131. The energy requirement for an industrial application is 1000 kWhr. If heat losses account for 20%, the total energy to be supplied is
(a) 1200 kWhr (b) 800 kWhr
(c) 1250 kWhr (d) 750 kWhr
(e) 1225 kWhr.

17.132. The cells are connected in series to
(a) increase the current output
(b) increase the voltage output
(c) decrease the internal resistance
(d) decrease the amount of charging voltage required
(e) increase the power rating.

17.133. A floating battery is one
(a) which is getting charged
(d) which is feeding load
(c) in which battery voltage is equal to charger voltage

(*d*) which gets charged and discharged simultaneously
(*e*) which normally feeds the load and gets charged when it is idle.

17.134. The sparking at the brushes in the d.c. generator is attributed to
(*a*) quick reversal of current in the coil under commutation
(*b*) armature reaction
(*c*) reactance voltage
(*d*) high resistance of the brushes
(*e*) inefficient operation of the motor.

17.135. The transformer is not used in the d.c. line because
(*a*) there is no need to step up the d.c. voltage
(*b*) losses in the d.c. circuit are high
(*c*) Faraday's law is not valid as the rate of change of flux is zero
(*d*) harmonics developed in the transformer will cause distortion in the voltage
(*e*) D.C. transformers are costly.

17.136. The purpose of laminating the transformer core is
(*a*) difficulty of fabricating solid core
(*b*) laminated core provides high flux density
(*c*) avoid eddy current and hysteresis losses
(*d*) increase the main flux
(*e*) reduce transformer cost.

17.137. The mechanical power developed by the d.c. motor is maximum when back e.m.f. is equal to
(*a*) applied voltage
(*b*) zero
(*c*) half the applied voltage
(*d*) twice the applied voltage
(*e*) one-fourth the applied voltage.

17.138. A series motor at no load develops
(*a*) zero speed (*b*) average speed
(*c*) rated speed (*d*) infinite speed
(*e*) none of the above.

17.139. In the case of d.c. shunt motor, the torque with increase in speed will
(*a*) increase linearly
(*b*) decrease linearly
(*c*) increase parabolically
(*d*) decrease parabolically
(*e*) remain unchanged.

17.140. If the supply terminals of d.c. shunt motor are interchanged, then
(*a*) motor will stop
(*b*) motor will run at its normal speed in the same direction as it was running
(*c*) the direction of rotation will reverse
(*d*) motor speed will increase
(*e*) motor will burn.

17.141. In the case of d.c. shunt generator, as the load current increases, the terminal voltage
(*a*) decreases gradually slightly from a maximum value
(*b*) increases linearly from zero
(*c*) decreases linearly from maximum to zero
(*d*) remains constant
(*e*) first increases and then decreases.

17.142. If a.c. is fed by mistake to a d.c. motor then the d.c. motor will
(*a*) burn as the eddy currents in the field produce heat
(*b*) run at its normal speed
(*c*) run at a lower speed
(*d*) run continuously but the sparking takes place at the brushes
(*e*) efficiency will be very poor.

17.143. The following motor is preferred for the locomotives motor drives
(*a*) a.c. series motor
(*b*) induction motor
(*c*) d.c. series motor
(*d*) synchronous motor
(*e*) single phase motor.

17.144. Which of the following motors has high starting torque ?
(*a*) d.c. shunt motor
(*b*) squirrel cage induction motor
(*c*) d.c. series motor
(*d*) a.c. series motor
(*e*) single phase motor.

17.145. In a d.c. generator, following loss will be minimum
(*a*) copper loss (*b*) iron loss
(*c*) friction loss
(*d*) shunt field copper loss
(*e*) windage loss.

17.146. If the excitation to the field of the d.c. motor is constant then the torque developed in the motor is proportional to
(*a*) armature current
(*b*) field current (*c*) speed
(*d*) magnetic flux (*e*) induced e.m.f.

17.147. Eddy current loss in a d.c. shunt generator is proportional to
(*a*) flux density (*b*) $\sqrt{\text{flux density}}$
(*c*) 1/flux density
(*d*) (flux density)^2
(*e*) $\frac{1}{\sqrt{\text{flux density}}}$.

17.148. The torque of a d.c. series motor with increase in speed
(*a*) increases gradually
(*b*) decreases linearly
(*c*) remains constant
(*d*) first decreases rapidly and then slowly
(*e*) first decreases slowly and then rapidly.

17.149. The function of the commutator in a d.c. machine is
(*a*) to change alternating current to a direct current
(*b*) to improve commutation
(*c*) to improve efficiency of motor
(*d*) to change alternating voltage to direct voltage
(*e*) to change direct voltage to alternating voltage.

17.150. The torque in induction motor is proportional to
(*a*) slip s (*b*) $1/s$
(*c*) s^2 (*d*) $1 - s$
(*e*) $\frac{1-s}{s}$.

17.151. Which of the following motors is usually used in house-hold refrigerator ?
(*a*) d.c. shunt motor
(*b*) reluctance motor
(*c*) single phase induction motor (split phase start or induction run motor)
(*d*) synchronous motor
(*e*) 3-phase induction motor.

17.152. The maximum temperature permitted for Class A insulation is
(*a*) 180°C (*b*) 105°C
(*c*) 120°C (*d*) 155°C
(*e*) 95°C.

17.153. The torque in the case of a wound rotor induction motor
(*a*) increases as rotor resistance is increased
(*b*) decreases as rotor resistance is increased
(*c*) remains unaffected by increase/decrease of rotor resistance
(*d*) is maximum when rotor is shorted
(*e*) is inversely proportional to speed.

17.154. For hoists and cranes, which motor should be selected
(*a*) 3 phase induction motor
(*b*) synchronous motor
(*c*) d.c. series motor
(*d*) d.c. shunt motor
(*e*) compound motor.

17.155. The power output of induction motor will be maximum when
(*a*) the equivalent load resistance is equal to the standstill reactance of the motor
(*b*) the equivalent load resistance is equal to the resistance of the rotor
(*c*) the equivalent resistance is equal to the standstill leakage impedance of the motor
(*d*) the slip is zero
(*e*) the slip is 5%.

17.156. The speed of an induction motor is
(*a*) synchronous speed
(*b*) synchronous speed × slip
(*c*) $\frac{\text{synchronous speed}}{(1 - \text{slip})}$
(*d*) synchronous speed $(1 - \text{slip})$
(*e*) synchronous speed $\left(\frac{1 - \text{slip}}{1 + \text{slip}}\right)$.

17.157. Which of the following motors has high starting torque
(*a*) a.c. motor (*b*) induction motor
(*c*) synchronous motor
(*d*) d.c. shunt motor
(*e*) d.c. series motor.

17.158. The starting torque of the slip ring induction motor is increased by
(*a*) adding external resistance to the rotor

(*b*) adding the external inductance to the rotor
(*c*) adding both external resistance and inductance to the rotor
(*d*) adding external capacitance to the rotor
(*e*) increasing the voltage fed to motor.

17.159. An underexcited synchronous motor draws current at
(*a*) unity power factor (p.f.)
(*b*) leading p.f. (*c*) lagging p.f.
(*d*) leading/lagging depending on underload/overload
(*e*) variable p.f. depending on speed.

17.160. The torque developed by an induction motor corresponding to zero slip is equal to
(*a*) maximum (*b*) full rated capacity
(*c*) zero (*d*) minimum
(*e*) half the rated capacity.

17.161. Which of the following motors is most frequently used in industries
(*a*) synchronous motor
(*b*) commutator motor
(*c*) single phase a.c. motor
(*d*) 3 phase induction motor
(*e*) series wound d.c. motor.

17.162. An induction motor is
(*a*) self-starting with zero torque
(*b*) self-starting with high torque
(*c*) self-starting with small torque than rated torque
(*d*) self-starting with infinite torque
(*e*) not self-starting.

17.163. Full load current of a 10 HP, 3 phase, 440 V induction motor is of the order of
(*a*) 7 A (*b*) 14 A
(*c*) 21 A (*d*) 28 A
(*e*) 35 A.

17.164. The starting current by a delta connected induction motor as compared to star connected motor under all other identical conditions is
(*a*) same (*b*) 2 times
(*c*) 3 times (*d*) 1/2 time
(*e*) 1/3 time.

17.165. The rotor slots are usually given slight skew in the squirrel case induction motor
(*a*) to increase the tensile strength of the rotor bars and hence strength
(*b*) to reduce the magnetic hum and locking tendency of the rotor
(*c*) to save the copper used
(*d*) because of ease in fabrication
(*e*) to reduce the electrical and mechanical losses.

17.166. The class C insulation can withstand
(*a*) 180°C (*b*) 150°C
(*c*) 200°C (*d*) 105°C
(*e*) 95°C.

17.167. The untreated paper falls in the following class of insulation
(*a*) A (*b*) B
(*c*) E (*d*) H
(*e*) O.

17.168. Mica tape falls under the following class of insulation
(*a*) A (*b*) B
(*c*) E (*d*) H
(*e*) O.

17.169. The material used for fuse must have
(*a*) low melting point and low specific resistance
(*b*) low melting point and high specific resistance
(*c*) high melting point and low specific resistance
(*d*) low melting point with any specific resistance
(*e*) none of the above.

17.170. The Buchholz relay is used to protect the
(*a*) alternators against all internal faults
(*b*) oil immersed transformers against all internal faults
(*c*) synchronous motor against all internal faults
(*d*) transmission lines against all short circuit faults
(*e*) motors

17.171. The earthing transformer is used
(*a*) to avoid the harmonics in the transformer
(*b*) to provide artificial neutral earthing where the neutral points of the three phase system are not accessible
(*c*) to improve the current capacity of the neutral wire

(*d*) improved efficiency
(*e*) never used.

17.172. The voltage regulation of a transformer is poor at
(*a*) unity power factor
(*b*) zero power factor
(*c*) leading power factor
(*d*) lagging power factor
(*e*) fluctuating power factor.

17.173. The copper losses in a transformer at half load compared to those at full load will be
(*a*) same (*b*) half
(*c*) one-fourth (*d*) 2 times
(*e*) 4 times.

17.174. It is essential that transformer oil should have no traces of moisture. The reason is that
(*a*) density of oil increases which reduces heat dissipation
(*b*) moisture will reduce the dielectric strength of the oil and hence insulation is weakened
(*c*) moisture will reduce the lubricating property of the oil
(*d*) moisture will develop rust
(*e*) moisture can lead to flash over.

17.175. Which of the following electrical machines has the highest efficiency ?
(*a*) d.c. shunt motor
(*b*) transformer
(*c*) induction motor
(*d*) synchronous motor
(*e*) invertor.

17.176. The condition for the maximum efficiency of the transformer is that
(*a*) copper losses are half of the iron losses
(*b*) copper losses are equal to iron losses
(*c*) copper losses are negligible in comparison to iron losses
(*d*) iron losses are zero
(*e*) copper losses are double the iron losses.

17.177. The operation of the electric generator and motor is based on the interaction between
(*a*) magnetic field and electric field
(*b*) magnetic field and electric current
(*c*) electric field and law of induction
(*d*) law of induction and dynamo-electric principle
(*e*) electric voltage and magnetic field.

17.178. Which of the following transformer will have smallest size with same electrical specifications ?
(*a*) Oil Natural Air Natural (ONAN) cooled transformer
(*b*) Dry type transformer
(*c*) Oil Natural Air Forced (ONAF) cooled transformer
(*d*) Oil Forced Water Forced (OFWF) cooled transformer
(*e*) Forced air cooled.

17.179. Which parameter is increased by step up transformer
(*a*) current (*b*) resistance
(*c*) voltage (*d*) frequency
(*e*) power.

17.180. Open circuit test on transformer measures
(*a*) impedance and insulation resistance
(*b*) voltage regulation
(*c*) eddy current loss
(*d*) copper loss (*e*) core loss.

17.181. In a step up transformer, which of the following is correct
(*a*) secondary power is more than primary
(*b*) secondary current is more than primary
(*c*) secondary turns are more than primary
(*d*) phase shift between secondary and primary is 180°
(*e*) all of the above.

17.182. The efficiency of a transformer is usually of the order of
(*a*) 33% (*b*) 50%
(*c*) 75% (*d*) 82%
(*e*) 98%.

17.183. The dielectric strength of transformer oil should be of the order of
(*a*) 415 V (*b*) 6.6 kV
(*c*) 11 kV (*d*) 30 kV
(*e*) 110 kV.

17.184. If the secondary winding of the current transformer is opened when current is flowing in the primary current, then following will result

(*a*) there will be high current in the secondary winding
(*b*) there will be very high induced voltage in the secondary winding
(*c*) there will be very weak flux density in the core
(*d*) the transformer will burn immediately
(*e*) nothing will happen.

17.185. It is possible to extend the range of an a.c. ammeter by using
(*a*) current transformer (CT)
(*b*) shunt
(*c*) capacitor
(*d*) inductor coil
(*e*) capacitor-resistor network.

17.186. Which of the following voltmeters would be selected for most accurate readings ?
(*a*) 100 V, 1 A
(*b*) 100 V, 100 ohms/volt
(*c*) 100 V, 1 mA
(*d*) 100 V, 100 mA
(*e*) 100 V, 10 mA.

17.187. Which of the following instrument will be used to measure alternating current ?
(*a*) moving iron voltmeter
(*b*) permanent magnet type ammeter
(*c*) induction type ammeter
(*d*) moving iron (attraction type) ammeter
(*e*) moving coil instrument.

17.188. The internal impedance of an accurate voltmeter should be
(*a*) as low as possible
(*b*) low (*c*) very low
(*d*) negligible (*e*) very high.

17.189. A moving coil instrument can be used to measure
(*a*) low frequency alternating current
(*b*) high frequency alternating current
(*c*) direct current
(*d*) direct current and alternating current both
(*e*) electrical power.

17.190. Which of the following statement is true?
(*a*) A galvanometer with low resistance in series is an ammeter
(*b*) A galvanometer with high resistance in series is an ammeter
(*c*) A galvanometer with high resistance in parallel is a voltmeter
(*d*) A galvanometer with low resistance in parallel is a voltmeter
(*e*) all of the above.

17.191. High current of the order of 100A can be measured by an ammeter of 0–1 A rating by using
(*a*) shunt (*b*) capacitor
(*c*) R-C network
(*d*) current transformer
(*e*) induction coil.

17.192. The insulation resistance of cables, transformers, etc. is measured by following instrument
(*a*) wheatstone bridge
(*b*) kelvin bridge
(*c*) meggar
(*d*) decade box
(*e*) voltmeter and ammeter.

17.193. A watt meter can be connected to a high current circuity by using
(*a*) eddy current transformer
(*b*) potential transformer
(*c*) current transformer
(*d*) shunt (*e*) inductor.

17.194. The Wheatstone bridge is used to measure
(*a*) low value of current
(*b*) high value of current
(*c*) high value of voltage
(*d*) low value of voltage
(*e*) resistance value.

17.195. The internal resistance of the milliammeter must be very low for
(*a*) high sensitivity
(*b*) high accuracy
(*c*) maximum voltage drop across the meter
(*d*) minimum effect on the current in the circuit
(*e*) safety of milliammeter.

17.196. The internal resistance of the voltmeter must be very high in order to have
(*a*) high voltage range
(*b*) minimum current through the meter
(*c*) maximum loading effect
(*d*) more current supplied by the voltage source
(*e*) safety of the instrument.

17.197. Friction losses are more in the following type of instrument
(*a*) dynamometer type
(*b*) moving coil type
(*c*) moving iron type
(*d*) null balance type
(*e*) moving magnet type.

17.198. A d.c. voltmeter can be directly used to measure
(*a*) power factor
(*b*) insulation resistance
(*c*) frequency
(*d*) polarity
(*e*) all of the above.

17.199. Large currents in d.c. circuits can be measured with
(*a*) current transformer and voltmeter
(*b*) potential transformer and milli voltmeter
(*c*) shunt and millivoltmeter
(*d*) R-C network and voltmeter
(*e*) micro ammeter.

17.200. Which of the following indicators is suitable only for direct current
(*a*) permanent magnet
(*b*) electro-dynamic
(*c*) moving iron
(*d*) hot wire
(*e*) all of the above.

17.201. The scale of a moving coil meter is
(*a*) linear (*b*) non-linear
(*c*) logarithmic
(*d*) uniform initially and then cramped
(*e*) exponential.

17.202. Bolometer is used in measurement of
(*a*) microwave power
(*b*) microwave current
(*c*) R.F. power
(*d*) audio power
(*e*) all of the above.

18

Engineering Metrology

18.1. Who made the following classic statement. "When you can measure what you are speaking about and express it in numbers, you know something about it, and when you can't express it in numbers, your knowledge, is of a meagre and unsatisfactory kind. It may be the beginning of knowledge, but you have scarcely in your thought advanced to the stage of science."
(*a*) Arnold Young (*b*) Taylorson
(*c*) Johanson (*d*) Lord Kelvin
(*e*) Taylor.

18.2. The ease with which observations can be made accurately is referred to as
(*a*) readability (*b*) sensitivity
(*c*) accuracy (*d*) precision
(*e*) repeatability.

18.3. Accuracy of measuring equipment is
(*a*) the closeness with which a measurement can be read directly from a measuring instrument.
(*b*) a measure of how close the reading is to the true size.
(*c*) the difference between measured value and actual value
(*d*) the smallest change in measurand that can be measured
(*e*) the capability to indicate the same reading again and again for a given measurand.

18.4. Which of the following errors are generally distributed in accordance with the Gaussian distribution
(*a*) controllable errors
(*b*) calibration errors
(*c*) avoidable errors
(*d*) random errors
(*e*) error due to ambient conditions.

18.5. Fig. 1 shows the dimension obtained on a component by a certain instrument

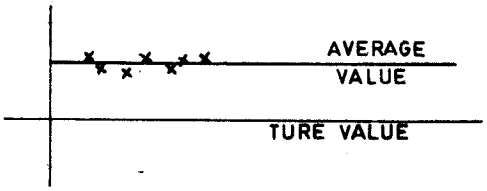

Fig. 1

This insrument is
(*a*) precise but not accurate
(*b*) accurate but not precise
(*c*) both accurate and precise
(*d*) neither precise nor accurate
(*e*) sensitive.

18.6. Tolerances are specified
(*a*) to obtain desired fits
(*b*) because it is not possible to manufacture a size exactly
(*c*) to obtain high accuracy
(*d*) to have proper allowance
(*e*) to have proper inspection.

18.7. Which of the following is the most important characteristic of a measuring instrument in general
(*a*) precision (*b*) accuracy
(*c*) repeatability (*d*) sensitivity
(*e*) readability.

18.8. Sensitivity and range of measuring instrument have

(*a*) direct relationship
(*b*) linear relationship
(*c*) inverse relationship
(*d*) unpredictable relationship
(*e*) no relationship.

18.9. Systematic errors are
(*a*) randomly distributed
(*b*) regularly repetitive in nature
(*c*) distributed on both + ve and - ve sides of mean value
(*d*) unknown errors
(*e*) of unpredictable nature.

18.10. Precision of measuring equipment is
(*a*) the closeness with which a measurement can be read directly from a measuring instrument
(*b*) a measure of how close the reading is to the true size
(*c*) the difference between measured value and actual value
(*d*) the smallest change in measurand that can be measured
(*e*) the capability to indicate the same reading again and again for a given measurand.

18.11. The maximum amount by which the result differs from the true value is called
(*a*) correction (*b*) discrepancy
(*c*) error (*d*) accuracy
(*e*) uncertainty.

18.12. Response is defined as the measure of a system's fidelity to purpose. The response of measuring instruments may be considered to the following cases
(*a*) amplitude response
(*b*) frequency response
(*c*) phase response
(*d*) delay or rise time
(*e*) all of the above.

18.13. Which of the following can be used to scribe lines parallel to the edges of a part
(*a*) vernier calipers
(*b*) screw gauge
(*c*) divider
(*d*) hermaphrodite caliper
(*e*) combination set.

18.14. Which of the following can't fall under the head — controllable errors
(*a*) calibration errors
(*b*) environmental errors
(*c*) avoidable errors
(*d*) random errors
(*e*) non-similarity of conditions while calibrating and measuring.

18.15. Which of the following errors are regularly repetitive in nature
(*a*) systematic errors
(*b*) random errors
(*c*) illegitimate errors
(*d*) controllable errors
(*e*) avoidable errors.

18.16. Which of the following errors are inevitable in the measuring system and it would be vainflul exercise to avoid them
(*a*) systematic errors
(*b*) random errors
(*c*) calibration errors
(*d*) environmental errors
(*e*) deformation errors.

18.17. The misalignment error ($D'-D$) in the case shown in Fig. 2 is equal to

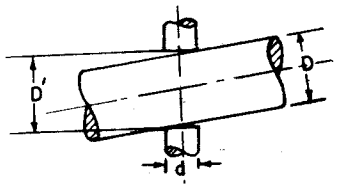

Fig. 2

(*a*) $D \sec\theta + d\tan\theta$
(*b*) $D \sec\theta + \frac{d}{2}\tan\theta$
(*c*) $D(\sec\theta + 1) + d\tan\theta$
(*d*) $D(\sec\theta - 1) + d\tan\theta$
(*e*) $D(\sec\theta - 1) + \frac{d}{2}\tan\theta$.

18.18. Which of the following instruments is most accurate
(*a*) vertical caliper
(*b*) manometric screw gauge
(*c*) optical projector
(*d*) mechanical comparator
(*e*) slip gauges.

18.19. Which of the following refers to parasitic error.
(*a*) Error, often gross, which results from incorrect execution of measurement

(*b*) algebraic difference between the results of measurement and the value of comparison

(*c*) error which varies in an unpredictable manner in absolute value and in sign when a large number of measurements of the same value of a quantity are made under practically identical conditions.

(*d*) disagreement between the result of measurement and the value of the quantity measured

(*e*) error which during several measurements, under the same conditions of the same value of a certain quantity, remains constant in absolute value and sign or varies in accordance with a specified law when the conditions change.

18.20. Which of the following characterises the dispersion of the results obtained in a series of measurements of the same value of a quantity measured

(*a*) absolute error (*b*) relative error
(*c*) root mean square deviation
(*d*) uncertainty of measurement
(*e*) variation of indication.

18.21. A surface gauge is used for

(*a*) levelling the surface plate
(*b*) checking the surface finish
(*c*) laying out the work accurately
(*d*) finding the depth of the surface
(*e*) finding flatness of surfaces.

18.22. Parasitic error is caused due to

(*a*) improper use of measuring instrument
(*b*) wrong design of instrument
(*c*) changes in ambient conditions
(*d*) errors in computation
(*e*) deflection of stylus.

18.23. If a quantity Q is dependent on three other quantities q_1, q_2 and q_3 related such that

$$Q = K (q_1)^{n1} \times (q_o)^{n2} \times (q_3)^{n3}$$

then overall error $\frac{\delta Q}{Q} =$

(*a*) $n_1 \left(\frac{\delta q_1}{q_1}\right) + n_2 \left(\frac{\delta q_2}{q_2}\right) + n_3 \left(\frac{\delta q_3}{q_3}\right)$

(*b*) $\frac{1}{n_1}\frac{\delta q_1}{q_1} + \frac{1}{n_2}\frac{\delta q_2}{q_2} + \frac{1}{n_3}\frac{\delta q_3}{q_3}$

(*c*) $\frac{\delta q_1}{q_1} + \frac{\delta q_2}{q_2} + \frac{\delta q_3}{q_3}$

(*d*) $\left(\frac{\delta q_1}{q_1}\right)^{n_1} + \left(\frac{\delta q_2}{q_2}\right)^{n_2} + \left(\frac{\delta q_3}{q_3}\right)^{n_3}$

(*e*) $n_1 \cdot n_2 \cdot n_3 \cdot \frac{\delta q_1}{q_1} \cdot \frac{\delta q_2}{q_2} \cdot \frac{\delta q_3}{q_3}$.

18.24. A feeler gauge is used to check

(*a*) radius (*b*) screw pitch
(*c*) surface roughness
(*d*) unsymmetrical shape
(*e*) thickness of clearance.

18.25. Measuring mechanism whose mobile component attains its equilibrium position without oscillations round new position is called

(*a*) damped measuring mechanism
(*b*) aperiodic measuring mechanism
(*c*) stable measuring mechanism
(*d*) precise measuring mechanism
(*e*) analogue measuring mechanism.

18.26. Measuring instrument which conforms to all the specified statutory provisions is called

(*a*) ordinary measuring instrument
(*b*) measuring instrument acceptable for verification
(*c*) auxiliary measuring instrument
(*d*) legal measuring instrument
(*e*) statutory measuring instrument.

18.27. Measuring instrument intended to define or present physically, conserve or reproduce the unit of measurement of a quantity (or a multiple or sub-multiple of that unit) and to transfer it to other measuring instruments by comparison is known as

(*a*) legal measuring standard
(*b*) secondary standard
(*c*) working standard
(*d*) primary standard
(*e*) standard.

18.28. Work is usually required to be held in a vertical position for laying out. For this purpose, it is clamped to

(*a*) surface plate (*b*) an angle plate
(*c*) a V-block (*d*) a machine bed
(*e*) enginee's square.

18.29. The phenomenon shown by a measuring instrument which gives different indica-

tions in a series of measurements of the same value of the quantity measured is called
(*a*) repeatability of measuring instrument
(*b*) error of repeatability
(*c*) dispersion of indications
(*d*) error of trueness
(*e*) discrimination of measuring instrument.

18.30. The quality of a measuring instrument which characterises the ability to respond to small changes of the quantity measured is called
(*a*) discrimination of a measuring instrument
(*b*) response of a measuring instrument
(*c*) accuracy
(*d*) precision
(*e*) repeatability.

18.31. Instrument which is designed to eliminate the personal element of feel when setting a measuring instrument is called
(*a*) fiducial indicator
(*b*) zero setting device
(*c*) auxiliary measuring instruments
(*d*) measuring standard
(*e*) indicating element.

18.32. The thickness of light gauge sheet steel can be best checked with a
(*a*) finely divided steel scale
(*b*) depth gauge
(*c*) hermaphrodite caliper
(*d*) micrometer
(*e*) thickness measuring machine fitted with dial gauge.

18.33. Which of the following gives an idea about the ability of the equipment to detect small vartiation in the input signal (quantity being measured)
(*a*) readability (*b*) accuracy
(*c*) sensivity (*d*) precision
(*e*) repeatability.

18.34. If attempts are made to make an instrument very sensitive, which of the following qualities is likely to be impaired
(*a*) precision (*b*) accuracy
(*c*) readability (*d*) rangeability
(*e*) all of the above.

18.35. Optical flats are made of
(*a*) quartz (*b*) glass
(*c*) plastic (*d*) steel
(*e*) silicon.

18.36. The axis of measurement of the scale or other dimensional reference should coincide. This principle is called the
(*a*) principle of kinematic design
(*b*) principle of alignment
(*c*) principle of linear measuring instruments
(*d*) principle of collinearity
(*e*) principle of location and movement.

18.37. Pick out the wrong statement about flexible strips.
(*a*) These are used in instruments where small movements are required between component parts
(*b*) no force or torque is required to displace a member located on flexible strip from its mid position
(*c*) it has no friction or backlash
(*d*) it is not subjected to wear
(*e*) it has negligible hysterisis.

18.38. The least count of a metric vernier caliper having 25 divisions on vernier scale, matching with 24 divisions of main scale (1 main scale division = 0.5 mm) is
(*a*) 0.05 mm (*b*) 0.01 mm
(*c*) 0.02 mm (*d*) 0.001 mm
(*e*) 0.005 mm.

18.39. A scale in which the distance between graduations if proportional to the value of that graduation is called
(*a*) regular scale (*b*) equidistant scale
(*c*) linear scale (*d*) line scale
(*e*) continuous scale.

18.40. A scale whose graduation marks are in a discontinuous manner and are composed of aligned numbers indicating directly the numerical value of the quantity measured is called
(*a*) linear scale (*b*) base of a linear scale
(*c*) equidistant scale
(*d*) regular scale
(*e*) digital scale.

18.41. Element of the indicating device carrying the scale is called
(*a*) dial (*b*) housing
(*c*) transducer (*d*) index
(*e*) frame.

18.42. The thread micrometer measures
(*a*) the major diameter of the thread
(*b*) the minor diameter of the thread
(*c*) the effective diameter of the thread
(*d*) the root diameter of the thread
(*e*) all the diameters of the thread.

18.43. V-block is used in the workshop to check
(*a*) roundness of a cylindrical work
(*b*) surface roughness
(*c*) dimensions of oval job
(*d*) taper on a job
(*e*) none of the above.

18.44. Repeatability of measuring equipment is
(*a*) the closeness with which a measurement can be read directly from a measuring instrument
(*b*) a measure of how close the reading is to the true size
(*c*) difference between measured value and actual valve
(*d*) the smallest change in measurand that can be measured
(*e*) the capability of indicate the same reading again and again for a given measurand.

18.45. The purpose of ratchet screw in micrometer screw gauge is
(*a*) to lock a dimension
(*b*) to impart blow motion
(*c*) to maintain sufficient and uniform measuring pressure
(*d*) to take care of wear of screw threads
(*e*) to allow zero adjustment.

18.46. The purpose of adjusting nut in a micrometer screw gauge is to
(*a*) take care of zero error
(*b*) impart slow motion
(*c*) compensate for wear between screw and nut
(*d*) take care of backlash
(*e*) ensure uniform measuring pressure.

18.47. The taper of internal dovetail can be measured with the help of
(*a*) sine bar (*b*) combination set
(*c*) balls of standard dimensions and slip gauges
(*d*) clinometer (*e*) dial gauges.

18.48. External taper can be accurately measured with the help of
(*a*) sine bar and slip gauges
(*b*) dividing head
(*c*) precision balls and height gauge
(*d*) combination set
(*e*) clinometer.

18.49. Stick micrometers are designed for measuring
(*a*) bore of cylinders
(*b*) longer external lengths
(*c*) cylindricity
(*d*) longer internal lengths
(*e*) diameters which can't be easily accessed.

18.50. Differential screw micrometer is used
(*a*) to give direct indication of difference between two readings
(*b*) to measure gap between grooves
(*c*) for digital readout
(*d*) to measure diameter of inaccessible holes
(*e*) for very high degree of accuracy.

18.51. A sine bar is specified by
(*a*) its total length
(*b*) the centre distance between the two rollers
(*c*) the size of the rollers
(*d*) the distance between rollers and upper surface
(*e*) weight of sine bar.

18.52. The diameter of very large bores can be measured accurately by
(*a*) flexibile graduated tape
(*b*) cylindrical gauge
(*c*) keilpart gauge
(*d*) four balls method
(*e*) swinging a pin gauge in the bore.

18.53. The number of slip gauges in a set are
(*a*) 87 (*b*) 45
(*c*) 103 (*d*) 31
(*e*) all of the above sets are available.

18.54. Profile of a gear tooth can be checked by
(*a*) sine bar (*b*) bench micrometer
(*c*) optical pyrometer
(*d*) optical projector
(*e*) slip gauges.

18.55. Gear tooth caliper is used to find the chordal thickness of the following type of gear tooth
(*a*) spur gears (*b*) helical gears
(*c*) worm gears (*d*) bevel gears
(*e*) any type of gear.

18.56. Fig. 3 shows a case of error in relative location of surfaces. This case is for

Fig. 3

(*a*) misalignment
(*b*) axial runout
(*c*) radial runout
(*d*) non parallelism of axes
(*e*) squareness error.

18.57. The M-and E-system in metrology are related with measurement of
(*a*) gears
(*b*) screw threads
(*c*) flatness
(*d*) angularity
(*e*) surface finish.

18.58. All the thread characteristics can be measured precisely with
(*a*) screw pitch gauge
(*b*) micrometer with V-anvil
(*c*) tool room microscope
(*d*) thread gauge
(*e*) thread measuring machine.

18.59. The advantage of vernier calpier over micrometer is that it
(*a*) is easier and quicker to use
(*b*) is more accurate
(*c*) can be used to make both inside and outside measurments over a range of sizes
(*d*) all of the above
(*e*) none of the above.

18.60. Standards to be used for reference purposes in laboratories and workshops are referred to as
(*a*) primary standards
(*b*) secondary standards
(*c*) tertiary standards
(*d*) working standards
(*e*) none of the above.

18.61. The cross section of International Prototype Metre is shown in (Refer Fig. 4)
(*a*) Figure *A* (*b*) Figure *B*
(*c*) Figure *C* (*d*) Figure *D*
(*e*) Figure *E*.

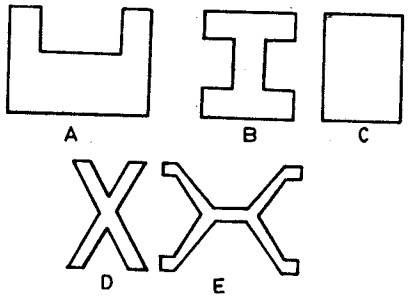

Fig. 4

18.62. The combination set can be used to
(*a*) check angular surfaces
(*b*) draw circles and arcs
(*c*) scribe lines
(*d*) all of the above
(*e*) none of the above.

18.63. In layout work, a pencil should not be used to draw lines on metal because
(*a*) it will wipe off easily
(*b*) the line will be too wide for accurate work
(*c*) the lines will smudge and be difficult to see
(*d*) the lines do remain on metal even after good rubbing
(*e*) all of the above.

18.64. Surface plate is usually made of grey cast iron because it provides
(*a*) non wearing plate
(*b*) very hard plate
(*c*) easy to cast plate
(*d*) lubrication due to graphite flakes
(*e*) stable plate.

18.65. The term traceability in Engineering Metrology is concerned with
(*a*) measuring machines
(*b*) optical instruments
(*c*) pneumatic comparator
(*d*) standards
(*e*) limits and fits.

18.66. In selective assembly
(*a*) parts in an assembly can be replaced by a similar part without any further alteration
(*b*) parts are produced on hole basis system
(*c*) all the parts are always interchangeable
(*d*) the size of one of the components is measured accurately and then mating component is made to match with this

(*e*) the parts of any one type are classified into several groups according to size.

18.67. Constant measuring pressure in micrometer screw gauges is ensured by
(*a*) locknut (*b*) barrel and thimble
(*c*) spindle (*d*) spanner
(*e*) ratchet.

18.68. The advantage of wavelength standard is that it would be possible to repeat measurements to a very high degree of accuracy. The wavelength standards can be reproduced to an accuracy of about one part in
(*a*) 1000 (*b*) 10^5
(*c*) 10^7 (*d*) 10^8
(*e*) 10^9.

18.69. The basic unit in angular measurements is
(*a*) degree (*b*) minute
(*c*) second (*d*) right angle
(*e*) 360°

18.70. Optical gauge works on the principle of
(*a*) refraction (*b*) reflection
(*c*) dispersion (*d*) polarisation
(*e*) interference of light rays.

18.71. The micrometer shown in Fig. 5 is called

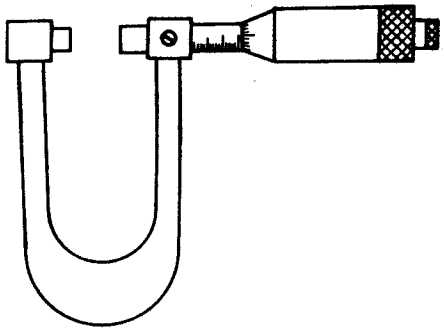

Fig. 5

(*a*) bench micrometer
(*b*) spline micrometer
(*c*) disc type micrometer
(*d*) tube micrometer
(*e*) sheet metal micrometer.

18.72. The micrometer shown in Fig. 6 is called
(*a*) tube micrometer
(*b*) sheet metal micrometer
(*c*) height micrometer
(*d*) disc type micrometer
(*e*) depth micrometer.

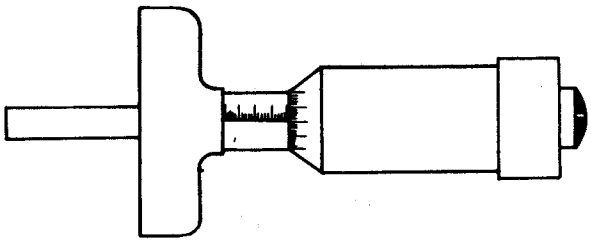

Fig. 6

18.73. Millimeter scale in a micrometer is marked on
(*a*) barrel (*b*) thimble
(*c*) spindle (*d*) anvil
(*e*) ratchet.

18.74. Circular scale of the micrometer is marked on
(*a*) anvil (*b*) barrel
(*c*) ratchet (*d*) thimble
(*e*) spindle.

18.75. According to well accepted practice, slip gauges which have been handled for a few minutes should be left for sometime. The reason for this could be
(*a*) the moisture transferred from hand would evaporate
(*b*) the structure of gauges, if disturbed would stabilise
(*c*) gauges attain the room temperature again
(*d*) with continuous use, gauges may wear quickly
(*e*) there is no such practice.

18.76. Which of the following is not the essential requirement for accuracy of measurement with a sine bar
(*a*) flatness of upper surface
(*b*) equality of size and roundness of rollers
(*c*) exact distance between roller axes and mutual parallelism
(*d*) parallelism between top and bottom surfaces
(*e*) parallelism of rollers to upper surface and equality of axis distance as from surface.

18.77. The following type of gauges has gauging sections combined on one end
(*a*) combination gauge
(*b*) limit gauge
(*c*) Go and No Go gauge

(*d*) fixed gauge
(*e*) progressive gauge.

18.78. The vernier reading should not be taken at its face value before an actual check has been taken for
(*a*) zero error (*b*) its calibration
(*c*) flatness of measuring jaws
(*d*) temperature equalisation
(*e*) all of the above.

18.79. Which comparator utilises the principle of a button spinning on a loop of string
(*a*) Sigma comparator
(*b*) Aramson comparator
(*c*) Optical comparator
(*d*) Zeiss interferometer
(*e*) Eden-Rolt comparator.

18.80. Gear tooth vernier is used to measure
(*a*) circular pitch (*b*) depth of tooth
(*c*) tooth thickness
(*d*) addendum and dedendum
(*e*) pitch line thickness of tooth.

18.81. Error of measuring equipment is
(*a*) the closeness with which a measurement can be read directly from a measuring instrument.
(*b*) a measure of how close the reading is to the true size
(*c*) the difference between measured value and actual value
(*d*) the smallest change in measureand that can be measured
(*e*) the capability to indicate the same reading again and again for a given measureand.

18.82. Which of the following is not provided on combination set
(*a*) centre head (*b*) protractor head
(*c*) vernier scale (*d*) spirit level
(*e*) squaring head.

18.83. Universal surface gauge is used
(*a*) for flatness testing
(*b*) for layout work and inspection
(*c*) for measuring profile of complex surface
(*d*) for measuring surface roughness
(*e*) for measuring concavity of surface.

18.84. Accuracy is
(*a*) the repeatability of a measuring process
(*b*) error of judgement in recording an observation
(*c*) the ability of instrument to reproduce same reading under identical situations
(*d*) agreement of the result of a measurement with the true value of the measured quantity
(*e*) the least resolution of an instrument.

18.85. Random errors follow the following distribution
(*a*) claussian (*b*) hyperbolic
(*c*) parabolic (*d*) t-student
(*e*) β-distribution.

18.86. Which one of the following is the least accurate measuring device
(*a*) air gauge
(*b*) micrometer screw gauge
(*c*) optical projector
(*d*) vernier micrometer
(*e*) steel scale.

18.87. Pick up the wrong statement :
(*a*) Accuracy of an instrument is closeness to the true dimension
(*b*) Precision represents the degree of repetitiveness.
(*c*) Sensitivity refers to minimum change in value that the instrument can reliably indicate.
(*d*) As the sensitivity of an instrument increase, its range of measurement also increases.
(*e*) If an instrument is not precise it will give different results for same dimension when measured again and again.

18.88. Fiducial indicators contain
(*a*) calibrated scale
(*b*) a single index mark
(*c*) micrometer screw movement
(*d*) optical head
(*e*) interferometric devices.

18.89. A comparator for its working depends on
(*a*) accurately calibrated scale
(*b*) comparison with standard such as slip gauges
(*c*) accurate micrometer gauge
(*d*) optical devices
(*e*) determining zero error of scale correctly.

18.90. Precision is

(*a*) the repeatability of a measuring process
(*b*) agreement of the result of a measurement with the true value of the measured quantity
(*c*) the ability of a measuring device to detect small differences in a quantity being measured
(*d*) the ability of an instrument to reproduce same reading under identical conditions
(*e*) error of judgment in reading an observation.

18.91. The thickness of oil film at the surface of slip gauges is of the order of
(*a*) .005 micron (*b*) .1 micron
(*c*) 1 micron (*d*) 10 microns
(*e*) 100 microns.

18.92. Pick up the wrong statement. Surface plates are usually made of granite because of following advantages
(*a*) because of long period of time for relaxing, it is free from built in residual stresses. There is no corrosion effect also.
(*b*) there is less tendency for it to warp
(*c*) if a tool or workpiece drops accidently over its surface, residual stresses are not induced
(*d*) it simply powders somewhat at the point of impact by falling object
(*e*) it enables the phenomenon of wringing flat surfaces over it.

18.93. Pick up the wrong statement.
(*a*) Error is the disagreement between the result of measurement and actual value.
(*b*) Random error are regularly repetitive in nature and result from improper conditions or procedures that are consistant in action
(*c*) Parasitic error results from incorrect execution of measurement.
(*d*) Uncertainty of measurement represents the dispersion of the result of measurement defined by the limits of the error.
(*e*) Absolute error is the algebraic difference between the result of measurement and the value of comparison.

18.94. Fig. 7 shows the principle of

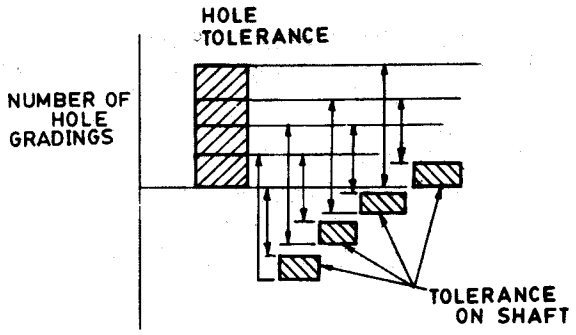

Fig. 7

(*a*) traceability (*b*) interchangeability
(*c*) matched fits (*d*) selective assembly
(*e*) limits, fits and tolerances.

18.95. As per IS specification, Fig. 8 shows vernier caliper of type

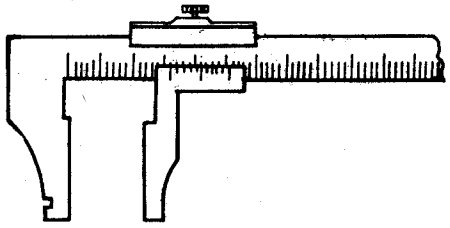

Fig. 8

(*a*) A (*b*) B
(*c*) C (*d*) AA
(*e*) BB.

18.96. Which one of the following instruments is the most accurate
(*a*) steel scale
(*b*) micrometer screw gauge
(*c*) vernier caliper
(*d*) vernier dial gauge
(*e*) optical projector.

18.97. In Fig. 9 which is the best method of wringing slip gauges

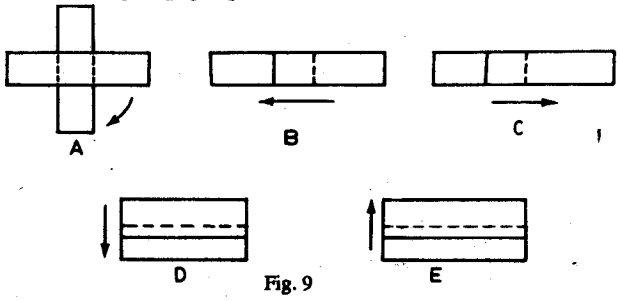

Fig. 9

(a) A (b) B
(c) C (d) D
(e) E.

18.98. In the case of high precision surface plates of diameter upto 200 mm, the working surface should lie between two parallel planes, whose maximum distance apart is
(a) 0.005 mm (b) 0.0005 mm
(c) 0.05 mm (d) 0.5 mm
(e) 0.001 mm.

18.99. A plug of diameter d rests in an angle as shown in Fig. 10. An equation giving distance L in terms of d, H and α would be

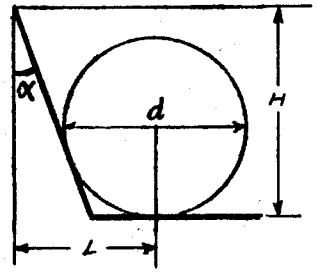

Fig. 10

(a) $L = H\tan\frac{\alpha}{2} + \frac{d}{2}\tan(45 - x)$

(b) $L = H\cot\frac{\alpha}{2} + \frac{d}{2}\tan\left(45 - \frac{\alpha}{2}\right)$

(c) $L = H\tan\alpha + \frac{d}{2}\tan a$

(d) $L = H\tan\alpha + \frac{d}{2}\tan\left(45 + \frac{\alpha}{2}\right)$

(e) $L = H\tan\alpha + \frac{d}{2}\tan\left(45 - \frac{\alpha}{2}\right)$

18.100. Fig. 11 shows the measurement of

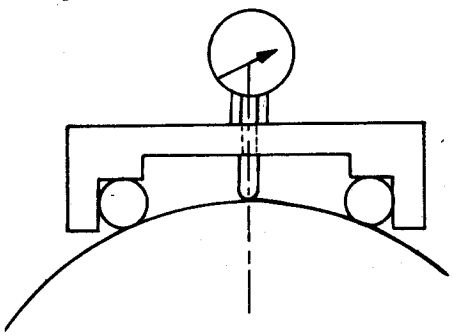

Fig. 11

(a) roundness (b) radius of curvature
(c) cylindricity (d) flatness
(e) surface texture.

18.101. Fig. 12 shows the radius measurement by dynamic method for concave surfaces. If T is the time of SHM of ball of radius r, then $R =$

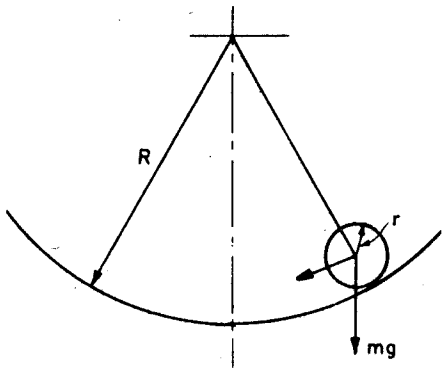

Fig. 12

(a) $r + \frac{Tg^2}{6\pi^2}$ (b) $r + \frac{Tg}{6\pi^2}$
(c) $\frac{r}{2} + \frac{T^2g}{3\pi^2}$ (d) $2r + \frac{Tg}{3\pi^2}$
(e) $r + \frac{Tg^2}{6\pi^2}$

18.102. The radius of a pulley block is measured as shown in Fig. 13

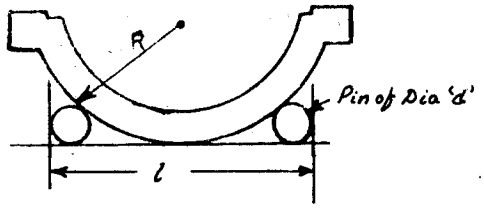

Fig. 13

(a) $R = \frac{l - d}{8d}$ (b) $R = \frac{(l - d)^2}{4d}$
(c) $R = \frac{(l - d)^2}{8d}$ (d) $R = \frac{l^2}{8d}$
(e) $R = \frac{(l - d)^2}{2d}$.

18.103. The radius of concave surface can be easily determined by a depth micrometer as shown in Fig. 14. Radius of curvature $R =$

(a) $\frac{d^2}{8h} + \frac{h}{2}$ (b) $\frac{d^2}{8h} - \frac{h}{2}$

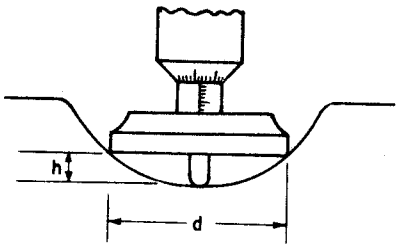

Fig. 14

(c) $\frac{d^2}{4h}+h$ (d) $\frac{d^2}{8h}+h$

(e) $\frac{d^2}{8h}+2h$.

18.104. For the situation shown in Fig. 15 the expression for H in terms of r, B and D would be

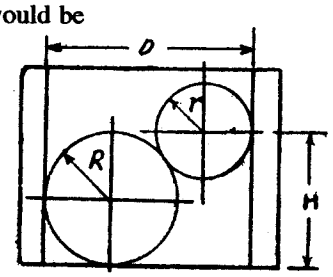

Fig. 15

(a) $H=\sqrt{R^2+r^2}$

(b) $H=(R+r)+(D+r)$

(c) $H=(R+r)+\sqrt{R^2-D^2}$

(d) $H=(R+r)+\sqrt{r+R^2-D^2}$

(e) $H=(R+r)+\sqrt{2D\,(R+r)-D^2}$.

18.105. Which of the following is not the accessory of slip gauges :

(a) scribing and centre points

(b) measuring jaws

(c) holder (d) calipers

(e) base.

18.106. The lateral faces of slip gauges are at right angles correct to within

(a) ± 1 degree (b) ± 30 minutes

(c) ± 10 minutes (d) ± 1 minute

(e) ± 10 seconds.

18.107. Protector gauge blocks in slip gauges are

(a) used as reference blocks

(b) mounted in the centre of pile

(c) never touched

(d) wrung on the end of combinations

(e) made of same material as the slip gauges.

18.108. According to accuracy, slip gauges are classed under following number of accuracy classes

(a) two (b) three

(c) five (d) seven

(e) ten.

18.109. A protector in slip gauges is provided to

(a) protect slip gauges when not is use

(b) take up all the wear when in use

(c) clean the slip gauges

(d) facilitate wringing of slip gauges

(e) assemble the slip gauges properly.

18.110. The ratio of the surface area A and the volume V of a cylinder of diameter d and length l is

(a) $\frac{A}{V}=\frac{6d}{l}$ (b) $\frac{A}{V}=\frac{4l}{d}$

(c) $\frac{A}{V}=\frac{l+d}{dl}$ (d) $\frac{A}{V}=\frac{6d+4l}{l}$

(e) $\frac{A}{V}=\frac{2d+4l}{dl}$.

18.111. Which of the figure below gives the correct disposition of manufacturing tolerances for screw thread limit gauges for both Go and Not Go gauges in case of ring caliper gauges.

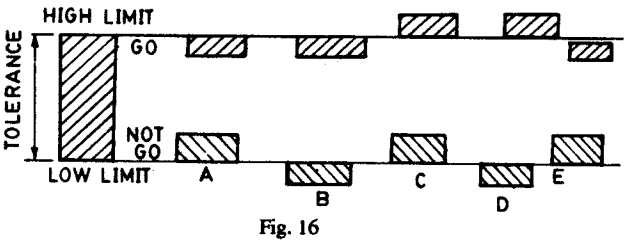

Fig. 16

(a) A (b) B

(c) C (d) C

(e) E.

18.112. The two slip gauges in precision measurement are joined by

(a) assembling (b) sliding

(c) adhesion (d) wringing

(e) slipping.

18.113. Plug gauges are used to

(a) measure the diameter of the workpieces

(b) measure the diameter of the holes in the workpieces

(*c*) check the diameter of the holes in the workpieces
(*d*) check the length of the holes in the workpieces
(*e*) check the outside diameter of workpieces.

18.114. Pick out the wrong statement about Taylor's principle of gauging.
(*a*) Go gauges should be full form gauges
(*b*) Go gauges should check all the related dimensions simultaneously
(*c*) It is sufficient to use Go gauges on the width and length of the component
(*d*) Not Go gauges should check only one dimension at a time
(*e*) It is useless to have the Not Go gauges of the full form.

18.115. Which of the figure below gives the correct disposition of manufacturing tolerances for screw thread limit gauges for both Go and Not Go gauges in case of plug gauges.

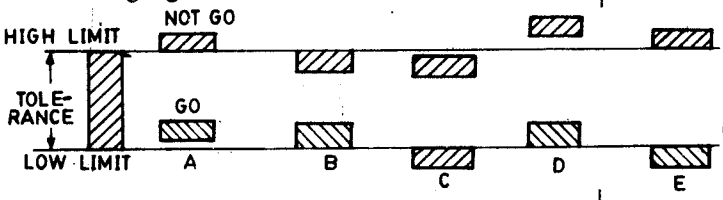

Fig. 17

(*a*) *A* (*b*) *B*
(*c*) *C* (*d*) *D*
(*e*) *E*.

18.116. The term "Allowance" in limits and fits is usually referred to
(*a*) minimum clearance between shaft and hole
(*b*) maximum clearance between shaft and hole
(*c*) difference of tolerances of hole and shaft
(*d*) difference between maximum size and minimum size of the hole
(*e*) difference between maximum size and minimum size of the shaft.

18.117. Which of the following is the correct way of designating fit
(*a*) H_8/g_7 (*b*) g_7/H_8
(*c*) $50\,H_8/g_7$ (*d*) $H_8/g_7 - 50$
(*e*) $50\,H_8/50h_7$.

18.118. Drilled holes, and honed holes, could be designated by following grades respectively
(*a*) H_5, H_{11} (*b*) H_6, H_{10}
(*c*) H_8, H_6 (*d*) H_{10}, P_5
(*e*) H_{11}, H_8.

18.119. The standard tolerance unit I in the case of limits and fits for sizes above 500 mm and upto 3150 mm is
(*a*) $0.45(\sqrt[3]{D}) + 0.001D$
(*b*) $0.52(\sqrt[3]{D}) + 0.001D$
(*c*) $0.30(\sqrt[3]{D}) + 0.042D$
(*d*) $0.005(\sqrt[3]{D})$
(*e*) $0.004D + 2.1$ (D is in mm).

18.120. Sensitivity of measuring equipment is
(*a*) the closeness with which a measurement can be read directly from a measuring instrument
(*b*) a measure of how close the reading is to the true size
(*c*) the difference between measured value and actual value
(*d*) the smallest change in measurand that can be measured
(*e*) the capability to indicate the same reading again and again for a given measurand.

18.121. Newall system of limits and fits is the oldest system working on hole basis system. The grades of holes and shafts specified respectively are
(*a*) 2, 6 (*b*) 1, 8
(*c*) 4, 12 (*d*) 6, 20
(*e*) 8, 26.

18.122. ISA tolerance system consists of following numbers of qualities of tolerance, and grades of fit respectively
(*a*) 6, 15 (*b*) 8, 20
(*c*) 12, 21 (*d*) 16, 21
(*e*) 21, 26.

18.123. Expressing a dimension as $25.3^{\pm 0.05}$ mm is the case of
(*a*) unilateral tolerance
(*b*) bilateral tolerance
(*c*) limiting dimensions
(*d*) all of the above
(*e*) none of the above.

18.124. Surface roughness on a drawing is represented by
(*a*) triangles (*b*) circles
(*c*) squares (*d*) rectangles
(*e*) none of the above.

18.125. Expressing a dimension as 32.5/32.3 mm is the case of
(*a*) unilateral tolerance
(*b*) bilateral tolerance
(*c*) limiting dimension
(*d*) all of the above
(*e*) none of the above.

18.126. A bore of 14.67 mm in a workpiece can be measured by
(*a*) steel rule (*b*) vernier caliper
(*c*) pneumatic gauge
(*d*) micrometer
(*e*) plug gauge.

18.127. In Fig. 18, size *A* refers to

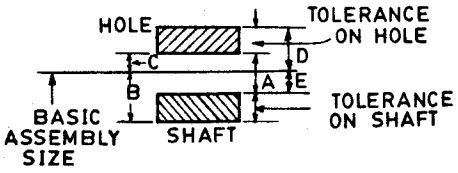

Fig. 18

(*a*) lower deviation
(*b*) minimum interference
(*c*) minimum clearance
(*d*) maximum clearance
(*e*) maximum transition.

18.128. In Fig. 18, sizes *B* and *C* refer to
(*a*) lower deviation
(*b*) upper deviation
(*c*) maximum clearance
(*d*) minimum clearance
(*e*) minimum allowance.

18.129. In Fig. 18, sizes *D* and *E* refer to
(*a*) lower deviation
(*b*) upper deviation
(*c*) maximum clearance
(*d*) minimum clearance
(*e*) minimum allowance.

18.130. The diameter of finish turned shaft can best be checked with a
(*a*) combination set
(*b*) slip gauge (*c*) height gauge
(*d*) micrometer screw gauge
(*e*) dial indicator.

18.131. One micron is equal to

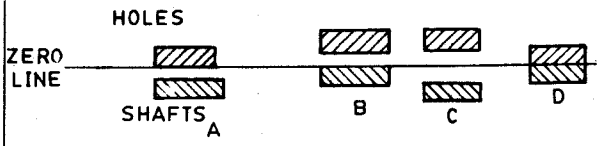

Fig. 19

(*a*) 1 mm (*b*) 0.1 mm
(*c*) 0.01 mm (*d*) 0.001 mm
(*e*) 0.0001 mm.

18.132. In Fig. 19, which of the combination of hole and shaft represents hole basis system

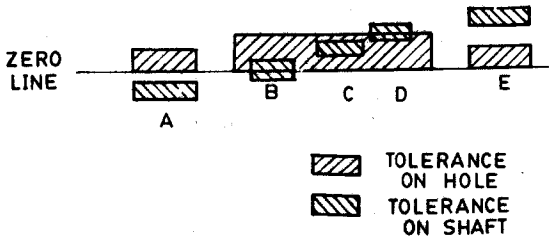

Fig. 20

(*a*) *A* (*b*) *B*
(*c*) *C* (*d*) *D*
(*e*) none of the above.

18.133. In Fig. 20 which of the following combination represents interference fit
(*a*) *A* (*b*) *B*
(*c*) *C* (*d*) *D*
(*e*) *E*.

18.134. Accurate centring of work mounted in an independent chuck can be determined by using a
(*a*) centre gauge (*b*) height gauge
(*c*) dial indicator (*d*) surface gauge
(*e*) micrometer.

18.135. In limits and fits system, basic shaft system is one whose
(*a*) lower deviation is zero
(*b*) upper deviation is zero
(*c*) minimum clearance is zero
(*d*) maximum clearance is zero
(*e*) standard tolerance is zero.

18.136. Which of the following is not the angle measuring device
(*a*) angle plate (*b*) sine bar
(*c*) bevel protector
(*d*) angle gauge
(*e*) combination square.

18.137. To check the diameter of a twist drill with a micrometer, the measurement must be taken across the
(*a*) margins of the drill
(*b*) flutes of the drill
(*c*) cutting edges of the drill
(*d*) lips of the drill
(*e*) web of the drill.

18.138. Pick out the wrong statement about gauges for internal threads.
(*a*) The Go screw plug gauge is made to the minimum metal limit and of full form and checks the virtual effective diameter. Any error in the pitch or flank angle of screw affects the effective diameter
(*b*) The minimum limit of the major diameter and maximum size of the effective diameter are also checked.
(*c*) Not Go screw plug gauge is made to the maximum effective diameter of the screw thread cleared at the root and crest.
(*d*) The plain Go and Not Go gauges are used for checking the limits of the size of minor diameter.
(*e*) The dimensions of Go and Not Go gauges correspond to maximum and minimum minor diameters.

18.139. Expressing a dimension as $18.3^{+0.00}_{-0.02}$ mm is the case of
(*a*) unilateral tolerance
(*b*) bilateral tolerance
(*c*) limiting dimensions
(*d*) all of the above
(*e*) none of the above.

18.140. In instrumentation a correction is
(*a*) an error
(*b*) the revision applied to the indicated value so that the final result obtained improves the worth of the result
(*c*) reading-error
(*d*) range of error-degree of correctness
(*e*) lowest value of input which does not indicate the result.

18.141. Many external comparators have anvils or work tables which are grooved. The purpose of this is to
(*a*) facilitate supporting of work.
(*b*) provide three point support to the work
(*c*) not to pass on inaccuracy of surface to the measurement
(*d*) trap any dirt on the table so that it does not interfere with the measurement
(*e*) avoid sticking of standards on the table.

18.142. Straight edges are used to measure
(*a*) straight length of parts
(*b*) flatness (*c*) parallelism
(*d*) perpendicularity
(*e*) circularity.

18.143. IS : 919 on limits and fits specifies following numbers of grades of fundamental tolerances, and fundamental deviations respectively
(*a*) 25, 18 (*b*) 25, 16
(*c*) 18, 22 (*d*) 18, 25
(*e*) 18, 20.

18.144. For general use the measuring tip of a comparator should be
(*a*) flat (*b*) spherical
(*c*) conical (*d*) concave
(*e*) grooved.

18.145. Basic shaft and basic hole are those whose upper deviations and lower deviation respectively are
(*a*) + ve, – ve (*b*) – ve, + ve
(*c*) minimum, minimum
(*d*) minimum, maximum
(*e*) zero, zero.

18.146. The standard tolerance unit is equal to
(*a*) $0.45(\sqrt[3]{D}) + 0.001D$
(*b*) $0.45(\sqrt[3]{D}) + 0.001D$
(*c*) $0.45(\sqrt[3]{D}) + 0.01D$
(*d*) $0.45(\sqrt[4]{D}) + 0.01D$
(*e*) $0.45(\sqrt[3]{D})$.
where D = geometric means of the lower and upper diameters of a particular diameter step.

18.147. Eden-Rolt comparator is a popular instrument for the
(*a*) calibration of slip gauges
(*b*) absolute measurement of length of slip gauges
(*c*) measurement of flatness
(*d*) measurement of angles

(*e*) measurement of linear movement.

18.148. It is desirable to handle the slip gauges with a cloth or chamois leather in order to
(*a*) avoid injury to hands
(*b*) protect the surfaces of slip gauges
(*c*) insulate them from the heat of the hand
(*d*) ensure that the varnish applied on gauges does not come out
(*e*) none of the above.

18.149. For grade IT 7, value of tolerance is equal to
(*a*) 7 *i* (*b*) 10 *i*
(*c*) 16 *i* (*d*) 25 *i*
(*e*) 40 *i*.

18.150. For defining length the standard generally followed is
(*a*) bar standard (*b*) end standard
(*c*) light wave standard
(*d*) any of the above
(*e*) none of the above.

18.151. Planer gauge is used for
(*a*) testing flatness of surface
(*b*) adding to utility of measurements on surface plate
(*c*) angular measurement
(*d*) testing radius of corners
(*e*) testing thickness of small gaps.

18.152. IS specifications specify vernier calipers as type *A*, *B* and *C*. This classification is based on
(*a*) accuracy (*b*) least count
(*c*) range
(*d*) internal or external measurement and for marking purpose
(*e*) type of graduations.

18.153. The cross-section of straight edges upto 180 mm length is
(*a*) rectangular (*b*) circular
(*c*) I-section (*d*) elliptical
(*e*) L-shape.

18.154. Optical micrometer is used to
(*a*) measure small linear displacements
(*b*) measure surface profiles
(*c*) measure surface roughness
(*d*) set very small displacement by rotating the glass block through relatively large angles
(*e*) check parallelism.

18.155. Airy points of support are
(*a*) 0.577 *L* apart (*b*) 0.554 *L* apart
(*c*) 0.5 *L* apart (*d*) 0.58 *L* apart
(*e*) 0.612 *L* apart
Where *L* = length of bar.

18.156. The maximum number of faces in precision polygons can be
(*a*) 6 (*b*) 8
(*c*) 12 (*d*) 20
(*e*) 72.

18.157. In precision polygon, a central hole and small holes are drilled through the thickness
(*a*) for mounting purposes
(*b*) to achieve high accuracy
(*c*) for ease of manufacture
(*d*) to make them light
(*e*) for decoration.

18.158. Precision polygons are calibrated from first principles using
(*a*) one autocollimator
(*b*) two autocollimators
(*c*) three autocollimators
(*d*) two precision spirit levels
(*e*) angle gauges.

18.159. The fact that how closely the instrument reading follows the measured variables is termed as
(*a*) fidelity (*b*) accuracy
(*c*) threshold sensitivity
(*d*) precision
(*e*) hysteresis.

18.160. Which of the following methods is not used for testing straightness
(*a*) spirit level method
(*b*) autocollimator
(*c*) interference method
(*d*) beam comparator
(*e*) laser beam.

18.161. Optical square is
(*a*) Engineer's square having stock and blade set at 90°
(*b*) a constant deviation prism having the angle of deviation between the incident ray and reflected ray, equal to 90°
(*c*) a constant deviation prism having the angle of deviation between the inci-

dent ray and reflected ray, equal to 45°
(*d*) used to produce interference fringes
(*e*) used for angular measurement.

18.162. In a sine bar the standard length is measured from
(*a*) edge to edge
(*b*) between inner circumference of two rollers
(*c*) between outer circumference of two rollers
(*d*) between the centres of two rollers
(*e*) none of the above.

18.163. Electronic level instrument is a replacement for
(*a*) vernier depth gauge
(*b*) microscope (*c*) auto-collimator
(*d*) angle dekkor (*e*) spirit level.

18.164. Polygons in metrology are concerned with
(*a*) method of circular dividing
(*b*) testing of parallelism
(*c*) testing of circularity
(*d*) interferrometry measurements
(*e*) linear measurements.

18.165. The long straight edges are supported at two points for minimum deflection at centre. The distance between supports compared to the length of straight edge should be
(*a*) 0.5 (*b*) 0.554
(*c*) 0.577 (*d*) 0.6
(*e*) 0.677.

18.166. Bevel protractor is used for
(*a*) angular measurements
(*b*) linear measurements
(*c*) height measurements
(*d*) flatness measurement
(*e*) parallelism measurement.

18.167. Clinometer is related with
(*a*) Engineer's parallels
(*b*) angle gauges
(*c*) spirit level
(*d*) bevel protractor
(*e*) tolerance measurement.

18.168. Pick up the correct statement. A comparator
(*a*) needs to be calibrated
(*b*) need not be calibrated
(*c*) contains a calibrated scale
(*d*) is highly accurate over its complete measuring range
(*e*) is best suited for measurement of absolute dimensions.

18.169. Which of the following is the essential condition for interferometry measurement
(*a*) an air gap (a wedge) of varying thickness must exist between the two surfaces
(*b*) an optical flat is required
(*c*) the work surface must be reflective
(*d*) monochromatic source of light is required
(*e*) all of the above.

18.170. Autocollimator is used for
(*a*) parallelism measurement
(*b*) straightness measurement
(*c*) flatness measurement
(*d*) angular measurement
(*e*) linear movement measurement.

18.171. The correct relationship for pneumatic comparator in Fig. 21 is represented by

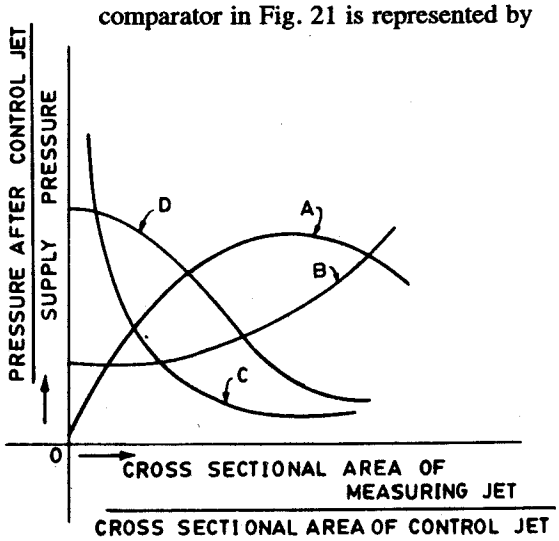

Fig. 21

(*a*) Curve *A* (*b*) Curve *B*
(*c*) Curve *C* (*d*) Curve *D*
(*e*) none of the above.

18.172. Fig. 22 shows
(*a*) pneumatic comparator
(*b*) flatness tester
(*c*) fluid gauge or hydraulic comparator
(*d*) level gauge
(*e*) manometer.

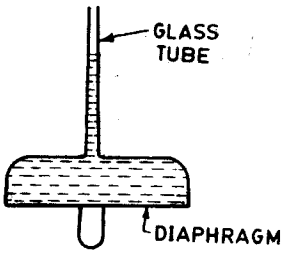

Fig. 22

18.173. If the fringe pattern on an optical flat is as shown in Fig. 23, the surface under flat would be

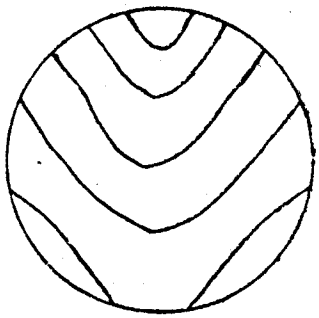

Fig. 23

(*a*) Perfectly flat (*b*) Cylindrical
(*c*) Spherical (*d*) Ridge or Valley
(*e*) Convex.

18.174. Which one of the following is an angle measuring device
(*a*) trammel
(*b*) hermaphrodite caliper
(*c*) divider (*d*) angle iron
(*e*) sine bar.

18.175. Filar microscopes
(*a*) have no reticles
(*b*) have fixed reticles
(*c*) have moving reticles
(*d*) can be moved relative to the work by means of a fine-pitch lead screw
(*e*) use a scale on the side of the optical tube to give a measure of the focusing position.

18.176. A collimator is simply a
(*a*) source of a bundle of parallel light rays
(*b*) source of point light
(*c*) sort of alignment telescope
(*d*) standard for flatness
(*e*) device used in interferometric measurements.

18.177. If x be half the included angle of thread and p its pitch, then best size wire's diameter for measurement of effective diameter of thread is
(*a*) $p/2 \sec x$ (*b*) $p \sec x/2$
(*c*) $p \cos x/2$ (*d*) $p/2 \cos x/2$
(*e*) $p/2 \sec x/2$.

18.178. Angle Dekkor is another type of
(*a*) auto-collimator
(*b*) optical square
(*c*) clinometer
(*d*) angle gauge
(*e*) electronic level.

18.179. The angles of angle gauges in the degrees series are
(*a*) 1, 3, 9, 25, 42 (*b*) 1, 3, 9, 27, 81
(*c*) 1, 3, 9, 27, 41 (*d*) 1, 5, 10, 25, 45
(*e*) 2, 3, 5, 27, 41.

18.180. Wickman gauge is used for inspection of
(*a*) holes (*b*) shafts
(*c*) gears (*d*) tapers
(*e*) screw threads.

18.181. Which one of the following is not an angle measuring device
(*a*) bevel protector
(*b*) sine bar
(*c*) combination square
(*d*) angle iron
(*e*) angle gauge blocks.

18.182. Fig. 24 shows a

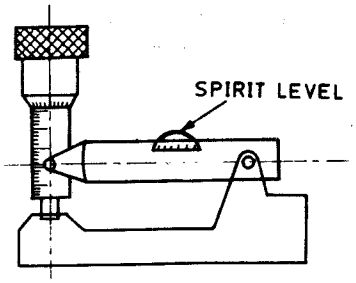

Fig. 24

(*a*) flatness tester
(*b*) micrometer clinometer
(*c*) sine centre
(*d*) pendulum clinometer
(*e*) taper tester.

18.183. The reflector combined with autocollimator can be used for checking
(*a*) alignment (*b*) parallelism
(*c*) circularity
(*d*) distance between two far off points
(*e*) surface finish.

18.184. Some substances generate voltage when they are subjected to mechanical forces or stresses along specific planes. Such substances are known as
(*a*) thermo-electric
(*b*) magneto-electric
(*c*) piezo-electric (*d*) photo-electric
(*e*) radio-active.

18.185. Tomlinson recorder is associated with measurement of
(*a*) surface flaws
(*b*) surface perpendicularity
(*c*) surface finish
(*d*) surface curvature
(*e*) surface flatness.

18.186. Which of the following methods is not concerned with surface finish measurement
(*a*) spectrophotometry method
(*b*) ultrasonic method
(*c*) field emission method
(*d*) critical angle of attack method
(*e*) Talysurf principle.

18.187. A spirit level is required to have 2 mm of bubble movement of 2" inclination. The radius of tube should be around
(*a*) 2 m (*b*) 20 mm
(*c*) 80 m (*d*) 120 m
(*e*) 200 m.

18.188. Fig. 25 shows the following type of interferometer

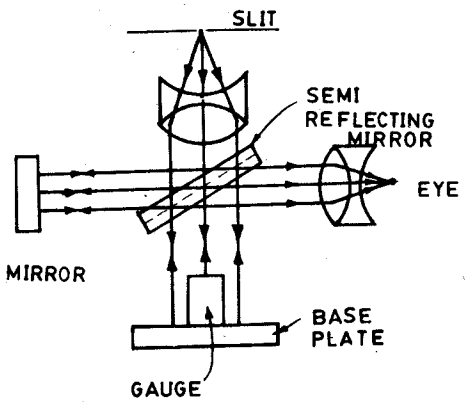

Fig. 25

(*a*) NPL gauge interferometer
(*b*) Michelson interferometer
(*c*) Twyman-Green modified Michelson interferometer
(*d*) Farbry-Perot interferometer
(*e*) Kosters gauge interferometer.

18.189. The only natural material producing a spectral line (6440° A red) almost completely symmetrical is
(*a*) Cadmium (*b*) Mercury
(*c*) Krypton (*d*) Helium
(*e*) Neon.

18.190. A photo-electric device in which the resistance of the metal changes directly proportional to the light striking on it, is known as
(*a*) photo-cell
(*b*) photo-emission cell
(*c*) photo-voltaic cell
(*d*) photo conductive cell
(*e*) none of the above.

18.191. Universal surface gauge is used for
(*a*) checking straightness
(*b*) checking flatness
(*c*) checking parallelism
(*d*) layout work and inspection
(*e*) checking the surface finish.

18.192. Which of the following is not the correct method of specifying numerical value of surface roughness

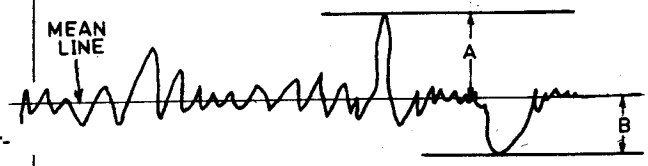

Fig. 26

(*a*) Centre-line average (CLA) value
(*b*) mean-line and envelop line systems
(*c*) r.m.s value
(*d*) peak-to-valley height
(*e*) roughness characteristic like depth of smoothness, mean depth etc.

18.193. Fig. 26 shows the roughness characteristics of a surface. Distances A and B represent
(*a*) CLA values
(*b*) peak to valley height

(*c*) depth of smoothness and mean depth respectively
(*d*) mean depth and depth of smoothness respectively
(*e*) fullness grade and emptiness grade respectively.

18.194. According to Taylor's Principle, No Go gauge checks
(*a*) only one feature at a time
(*b*) only important dimensions at a time
(*c*) all the dimensions at a time
(*d*) only the related dimensions at a time
(*e*) as many dimensions as possible at a time.

18.195. The primary texture or roughness or micro-errors on surface results due to
(*a*) normal action of the tool in production process
(*b*) vibrations and non-uniformity of cutting process
(*c*) flaws in material
(*d*) dominant direction of tool marks (lay)
(*e*) all of the above.

18.196. The secondary texture or waviness, or macro-error on surface results due to
(*a*) normal action of the tool in production process
(*b*) vibrations and non-uniformity of cutting process
(*c*) flaws in material
(*d*) dominant direction of tool marks (lay)
(*e*) all of the above.

18.197. The function of a transducer is
(*a*) to amplify the input signal
(*b*) to modify the input signal
(*c*) to convert the primary signal into a more useful quantity usually an electrical impulse
(*d*) to codify the input signal
(*e*) to decodify the input signal.

18.198. Pick up the correct statement in connection with surface finish.
(*a*) Pitch of secondary texture is same as pitch of primary texture
(*b*) Pitch of secondary texture is more than pitch of primary texture
(*c*) Pitch of secondary texture is less than pitch of primary texture
(*d*) Pitch of primary and secondary texture can't have any relationship
(*e*) Pitch of primary and secondary textures is related mathematically.

18.199. If graduations on beam of a vernier gauge are marked at every 1/2 mm and 10 divisions on vernier scale are on a distance of 9.5 mm, then least count is
(*a*) 0.1 mm (*b*) 0.05 mm
(*c*) 0.01 mm (*d*) 0.02 mm
(*e*) 0.005 mm.

18.200. Scale sensitivity is defined as
(*a*) Ratio of a change in scale reading to corresponding change in pointer deflection
(*b*) Least reading of scale/range of scale
(*c*) Least reading of scale/unit measurable quantity
(*d*) Least count of scale/range of scale
(*e*) none of the above.

18.201. A three-lobed part if checked on 60° V-block would provide following magnification of the radial out-of-round characteristics
(*a*) 1 time (*b*) 2 time
(*c*) 3 time (*d*) 4 time
(*e*) 5 time.

18.202. A five-lobed part, if gauged in the 60° V-block would produce the following magnification of the radial out-of-round characteristics
(*a*) 0 time (*b*) 1 time
(*c*) 2 times (*d*) 3 times
(*e*) 5 times.

18.203. Diametral gauging for out-of-roundness measurement is not sufficient because
(*a*) it can't sense even lobed parts
(*b*) radial changes always occur which can't be sensed by it
(*c*) it is difficult to find true centre
(*d*) its readings can't be fed to computer
(*e*) it provides measurement at 2 points only.

18.204. A plug gauge is used for measuring
(*a*) cylinders
(*b*) cylindrical bores
(*c*) spherical holes
(*d*) screw threads
(*e*) angles.

18.205. For grade '1' micrometer screw gauge, the total error at 20°C should not exceed

(*a*) $\left(4+\frac{L}{100}\right)\mu m$ (*b*) $\left(10+\frac{L}{50}\right)\mu m$

(*c*) $\left(5+\frac{L}{50}\right)\mu m$ (*d*) $\left(4+\frac{L}{200}\right)\mu m$

(*e*) $\left(10+\frac{L}{20}\right)\mu m$.

where L = upper limit of the measuring range in mm.

18.206. Pick out the wrong statement about measuring out-of-roundness by V-block gauging.

(*a*) 60 degree V-block provides triple magnification of out-of-round characteristics of 3 lobed part.

(*b*) A-five lobed part may be gauged in the 60° V-block and produce a zero reading, registering wrongly that the part is round.

(*c*) For checking a five lobed part, 108° V is required

(*d*) The use of a series of V blocks would not necessarily detect all types of out-of-roundness.

(*e*) With a V-block, ovality and other even-numbered lobing are magnified.

18.207. A master gauge is

(*a*) a new gauge

(*b*) an international reference standard

(*c*) a standard gauge for checking accuracy of gauges used on shop floors

(*d*) a gauge used by experienced technicians

(*e*) the most accurate gauge.

18.208. Gear tooth vernier is used to measure

(*a*) gear tooth profile

(*b*) gear tooth thickness

(*c*) pitch line thickness of gear tooth

(*d*) module

(*e*) addendum and dedendum.

18.209. Moire fringes are observed when

(*a*) an optical flat is placed over smooth surface

(*b*) a microscope is used to observe surface texture

(*c*) index grating is moved over scale grating

(*d*) white light is diffused through a prism

(*e*) two monochromatic light beams have a phase difference of half the wavelength.

18.210. The surface roughness on a drawing is represented by

(*a*) circles (*b*) squares

(*c*) zig-zag lines (*d*) triangles

(*e*) curves.

18.211. Inside and outside diameters of a thin tube are to be measured. Only one of the following tools is to be selected. Which one would you choose.

(*a*) inside caliper (*b*) outside caliper

(*c*) trammel (*d*) odd-leg caliper

(*e*) vernier caliper.

18.212. Fig. 27 shows the principle of

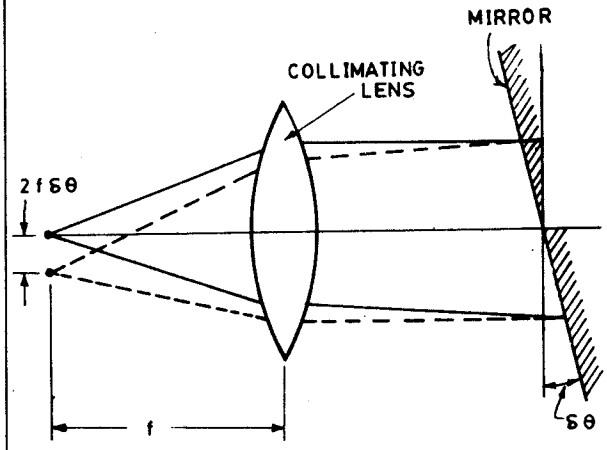

Fig. 27

(*a*) microscope (*b*) telescope

(*c*) optical clinometer

(*d*) auto collimator

(*e*) projector.

18.213. Electronic level contains

(*a*) a pendulum (*b*) spirit level

(*c*) micrometer (*d*) clinometer

(*e*) sine bar.

18.214. Keilpart gauge is used to measure

(*a*) surface roughness

(*b*) taper

(*c*) inside diameter of a tool

(*d*) gear eccentricity

(*e*) effective diameter of a screw thread.

18.215. In interferometric methods, the path difference between one bright band and the next is varied by
(*a*) half wave length
(*b*) two half wave lengths
(*c*) one quarter wavelength
(*d*) two wavelengths
(*e*) none of the above.

18.216. The 'best size wire' for measuring the effective diameter of threads is of diameter
(*a*) $\frac{p \sec \theta}{2}$ (p = pitch of thread, θ = semi-angle of thread)
(*b*) $\frac{p \cos \theta}{2}$ (*c*) $p \sec \theta$
(*d*) $\frac{p \sec \theta}{4}$ (*e*) $2p \sec \theta$.

18.217. On a triple thread screw
(*a*) lead = pitch
(*b*) lead = 3 pitch
(*c*) lead = $\frac{1}{2}$ pitch
(*d*) lead = 9 pitch
(*e*) 9 lead = pitch.

18.218. Gratings are used in connection with
(*a*) flatness measurement
(*b*) roundness measurement
(*c*) surface texture measurement
(*d*) convexity/concavity measurement
(*e*) linear displacement measurements.

18.219. The method of fractional coincidences in interferometry techniques is used for
(*a*) Measurement of end gauges
(*b*) flatness of surface
(*c*) linear displacement measurements
(*d*) convexity/concavity of surfaces
(*e*) surface roughness measurement.

18.220. An optical gauge works on the principle of
(*a*) reflection of light rays
(*b*) polarisation of light rays
(*c*) interference of light rays
(*d*) refraction of light rays
(*e*) dispersion of light rays.

18.221. Involute function of a gear is defined as
(*a*) (cos $\alpha - \alpha$) radians
(*b*) (sin $\alpha - \alpha$) radians
(*c*) (tan $\alpha - \alpha$) radians
(*d*) (cot $\alpha - \alpha$) radians
(*e*) (sec $\alpha - \alpha$) radians.

18.222. The pitch circle raidus r_p and base circle radius r_b of a gear are related by the following relationship (α = pressure angle)
(*a*) $r_b = r_p \cos \alpha$ (*b*) $r_b = \frac{r_b}{\cos \alpha}$
(*c*) $r_b = r_p \sin \alpha$ (*d*) $r_b = r_p \tan \alpha$
(*e*) $r_b = r_r (\tan \alpha - \alpha)$.

18.223. The diameter of a large bore is measured by rocking a pin gauge in it as shown in Fig. 28. If L be length of pin, and $2l$ the swing, then diameter D is nearly equal to

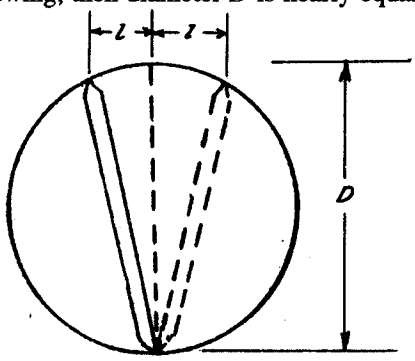

Fig. 28

(*a*) $L + \frac{l^2}{2L}$ (*b*) $L + \frac{l^2}{L}$
(*c*) $L + \frac{l^2}{4L}$ (*d*) $L + \frac{l^2}{8L}$
(*e*) $L + \frac{l^2}{3L}$.

18.224. The undercutting in case of $14\frac{1}{2}$ degree full depth involute teeth occurs when the number of teeth is less than
(*a*) 10 (*b*) 16
(*c*) 18 (*d*) 25
(*e*) 32.

18.225. During the gear tooth cutting operation the undercutting may occur, due to the corners of the cutter biting into the true involute curve on the flank of the tooth. This is called interference. It can be avoided by
(*a*) increasing the addendum on the pinion and reducing on the gear wheel
(*b*) increasing the addendum on both pinion and gear wheel

(c) reducing the addendum on both pinion and gear wheel
(d) reducing the addendum on the pinion and increasing on the gear wheel
(e) none of the above.

18.226. A sine bar is used to measure
(a) surface roughness
(b) gear profiles
(c) internal tapers
(d) external tapers
(e) all of the above.

18.227. The normal chordal tooth thickness of a gear is the shortest distance from the
(a) tooth crest to the point of the chord
(b) tooth crest to the mid point of the chord
(c) mid point of the constant chord to the tip of the tooth
(d) from the tooth crest to any point on the chord
(e) mid point of the constant chord to tip of the tooth.

18.228. Addendum of a gear is equal to
(a) Pitch p (b) 0.3 p
(c) 0.3183 p (d) 0.3683 p
(e) 0.6866 p.

18.229. Optical flats are used in conjunction with
(a) angular measurements
(b) surface flatness
(c) surface parallelism
(d) interferrometric measurement
(e) surface profiles.

18.230. In the phenomenon of optical interference, the two beams of light, both originating from the same source, can cause interference patterns when the path difference between them amounts to
(a) 1 micron (b) 1 mm
(c) one wavelength of the light being used
(d) an odd half-wavelength of the light being used
(e) an even half-wavelength of the light being used.

18.231. The NPL gauge Interferometer is designed and used for
(a) absolute measurement of length of slip gauges
(b) judging flatness of surface
(c) comparing height with a standard reference
(d) measurement of fringe displacement
(e) parallelism of two ends of slip gauge.

18.232. A 20 mm diameter international metric thread will have a pitch of
(a) 1 mm (b) 1.25 mm
(c) 1.50 mm (d) 2.0 mm
(e) 2.5 mm.

18.233. Wear allowance is provided on
(a) Go gauge
(b) No Go gauge
(c) both Go and No Go gauges
(d) when both are combined in one gauge
(e) neither Go nor No Go Gauge.

18.234. Which of the following gauge is of full form
(a) Go gauge (b) No Go gauge
(c) snap gauge (d) thread gauge
(e) double ended gauge.

18.235. Taylor's principle is cocerned with
(a) pneumatic comparators
(b) interferometric measurements
(c) gauging measurements
(d) angular measurements
(e) roundness measurements.

18.236. Accuracy of setting a sine bar
(a) is poor for smaller angles
(b) is maximum when angle of measurement is 45°
(c) decreases appreciably with steep angle
(d) is dependent on accuracy of outer dimensions of sine bar
(e) is function of size of rollers of sine bar.

18.237. The radius of curvature of tube in precise spirit level is of the order of
(a) 10 cm (b) 50 cm
(c) 1 m (d) 10 cm
(e) 50 m.

18.238. Profile of a gear tooth is to be checked. Which one of the following device would you choose
(a) optical pyrometer
(b) bench micrometer
(c) sine bar
(d) telescopic gauge
(e) optical projector.

18.239. Clinometer is an instrument concerned with
(*a*) temperature measurement
(*b*) flatness measurement
(*c*) linear measurement
(*d*) roundness measurement
(*e*) angular measurement.

18.240. Auto-collimator is used for measurement of
(*a*) small angular differences
(*b*) flatness
(*c*) linear surfaces (*d*) concavity
(*e*) roughness surface.

18.241. Optical square is used in connection with
(*a*) alignment tests involving two surfaces at right angles
(*b*) interferometry measurements
(*c*) angular measurements
(*d*) circular division
(*e*) measurement of flatness of surface.

18.242. According to Indian standards, the slip gauges according to accuracy are graded into following categories
(*a*) 2 (*b*) 3
(*c*) 4 (*d*) 5
(*e*) 6.

18.243. In which of the following inspection system, the inspection keeps pace with the production
(*a*) sampling inspection
(*b*) cent percent inspection
(*c*) cage inspection
(*d*) centralised inspection
(*e*) floor or patrol inspection.

18.244. In inspection by attributes
(*a*) good quantities are separated from bad
(*b*) quality under consideration is measured on some scale expressing it quantitatively
(*c*) variations due to assignable factors are determined
(*d*) variations due to chance factors are determined
(*e*) theory of probability is applicable.

18.245. The square of the standard deviation is also called
(*a*) skewness (*b*) variance
(*c*) medium (*d*) mode
(*e*) range.

18.246. In an interferometer experiment, following pattern of fringes was observed. The surface being tested is

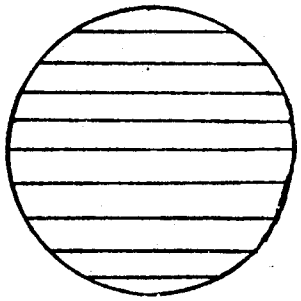

Fig. 29

(*a*) flat (*b*) convex
(*c*) convave
(*d*) ridge/valley in the middle
(*e*) smooth cylindrical surface.

18.247. If the interference bands with optical flat are as shown in Fig. 30, the surface would

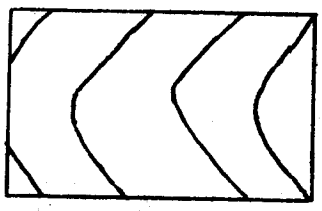

Fig. 30

be
(*a*) convex (*b*) concave
(*c*) ridge
(*d*) progressively convex
(*e*) uneven.

18.248. A scale in which the distance between graduations is proportional to the value of that graduation is called
(*a*) equidistant scale
(*b*) regular scale
(*c*) linear scale
(*d*) scale with a constant value of grauda-tion
(*e*) non-linear scale.

18.249. Coefficient of variation in terms of standard deviation is defined as
(*a*) $\sigma^2 \times 100$ (*b*) $\sqrt{\sigma} \times 100$
(*c*) $\frac{\sigma}{\bar{X}} \times 100$ (*d*) $\frac{\sigma}{R} \times 100$
(*e*) $\pm 3\sigma \times 100$.

($\bar{X}$ and R represent mean value and range respectively).

18.250. Profilometer is an instrument used to measure
(*a*) gear involute (*b*) thread profile
(*c*) taper (*d*) surface roughness
(*e*) surface flatness.

18.251. Variance is defined as
(*a*) $\frac{\sigma}{2}$ (*b*) $\pm 3\sigma$
(*c*) $\sqrt{\sigma}$ (*d*) σ^2
(*e*) $\frac{\sigma}{\bar{X}}$
(σ = standard deviation and $\bar{X}$ = mean value).

18.252. The value of a set of data at which the greatest number of cases is concentrated is called
(*a*) mean (*b*) median
(*c*) range (*d*) standard deviation
(*e*) mode.

18.253. If the correctness of profile of a thread is to be checked, which instrument would you choose
(*a*) bench micrometer
(*b*) screw pitch gauge
(*c*) sine bar
(*d*) telescopic gauge
(*e*) optical projector.

18.254. The more sensitive instrument
(*a*) first oscillates more
(*b*) oscillates more slowly
(*c*) has no oscillations
(*d*) is never stable
(*e*) unstable.

18.255. Fig. 31 shows the time displacement relation for damped motion. Which of the curves is applicable for underdamped system

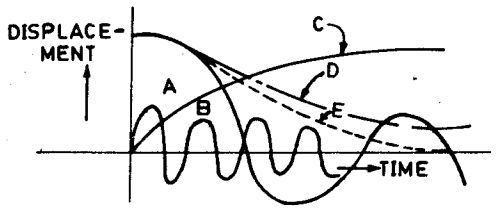

Fig. 31

(*a*) *A* (*b*) *B*
(*c*) *C* (*d*) *D*
(*e*) *E*.

18.256. Frequency of oscillation of an instrument indicating device is a function of
(*a*) mass (*b*) damping
(*c*) sensitivity
(*d*) both damping and sensitivity
(*e*) all of above, *i.e.* mass, damping and sensitivity.

18.257. The lost motion of the spindle in micrometer screw gauge when the rotation of the thimble is changed in direction is referred to as
(*a*) wear (*b*) least count
(*c*) total error (*d*) backlash
(*e*) accuracy.

18.258. Stick micrometers are used for measuring
(*a*) depth of holes
(*b*) longer internal lengths
(*c*) longer external lengths
(*d*) height of parts
(*e*) very small diameters.

18.259. All the working surfaces and the cylindrical surfaces of the rollers of sine bar have a surface finish of the order of
(*a*) 0.2. micron (*b*) 0.5 micron
(*c*) 1 micron (*d*) 5 micron
(*e*) 10 micron.

18.260. The effect of errors in spacing of the rollers, or height of slip gauge combination is a function of the
(*a*) $\sin\theta$ (*b*) $\cos\theta$
(*c*) $\tan\theta$ (*d*) $\operatorname{cosec}\theta$
(*e*) $\sec\theta$.

18.261. Sine centre is used for measurement of
(*a*) included internal angle between two faces
(*b*) height of projected parts
(*c*) semi-angle of taper of a job
(*d*) flatness
(*e*) any one of the above.

18.262. Clinometer is used for
(*a*) angular measurement
(*b*) linear measurement
(*c*) bore measurement
(*d*) measurements of environmental conditions
(*e*) level of flat surfaces.

18.263. The change in pitch diameter of a screw thread (d) and the pitch error (δp) are approximately related as under

(a) $\delta d \cong \delta p$ (b) $\delta p \cong \delta p/2$
(c) $\delta d \cong 2\delta p$ (d) $\delta d \cong 1.5\,\delta p$
(e) $\delta d \cong 3\,\delta p$.

18.264. Pick up the correct statement. The effect of pitch error and angle error is to

(a) increase the simple effective diameters of a bolt and decrease that of a nut
(b) decrease the simple effective diameter of a bolt and increase that of a nut
(c) increase the simple effective diameter of both bolt and nut
(d) decrease the simple effective diameters of both bolt and nut
(e) have no effect on simple effective diameters of bolt and nut.

18.265. If θ is the included angle of a screw thread then change in simple effective diameter due to change in angle error is proportional to

(a) $\tan\theta$ (b) $\sin\theta$
(c) $\cos\theta$ (d) $\sec\theta$
(e) $\text{cosec}\,\theta$.

18.266. The best size wire for ISO metric thread for measuring pitch diameters of screw thread in terms of its pitch p is

(a) $0.5\,p$ (b) $0.6\,p$
(c) $0.75\,p$ (d) $0.5773\,p$
(e) $0.4227\,p$.