



GOVERNMENT OF INDIA :: DEPARTMENT OF SPACE
INDIAN SPACE RESEARCH ORGANISATION
ISRO Centralised Recruitment Board
Recruitment for Scientist/Engineer 'SC'

Test Booklet		CIVIL	A
Date	:	January 12, 2020 (Sunday)	
Time	:	1200 hrs to 1330 hrs	
Test Duration (Minutes)	:	90	
No. of Questions	:	80	
No. of Pages (Other than cover sheet)	:	16	

Instructions to the candidates

1. The question paper is in the form of test booklet. All candidates will be assessed on identical questions.
2. A separate **OMR** answer sheet is provided to all candidates for answering.
3. Each objective question is provided with a text and/or figures wherever applicable with **multiple answer choices (a), (b), (c) and (d)**. Choose the most appropriate answer.
4. Read the instructions on the **OMR** sheet carefully. Use only **Black or Blue Ball Point Pen** for writing on OMR sheet and marking/bubbling your answers.
5. All objective type questions carry equal marks of **THREE** for a correct answer, **ZERO** for no answer and minus **ONE** for a wrong answer.
6. **Multiple answers** for a question will be regarded as a wrong answer.
7. Although the test stresses on accuracy more than speed, it is important to use time as effectively as possible.
8. Do not spend time on questions, which are difficult for you. Go on to other questions and come back to the difficult ones later.
9. Question booklets have been marked with **A** or **B** or **C** or **D** or **E** on the right hand top corner, which is mandatory to be written on the OMR sheet in the box and bubbled appropriately, failing which, the answer sheet will not be evaluated.
10. Space available in the booklet could be used for rough work, if required. No separate sheet will be provided.
11. Attempt of any malpractice in the exam hall shall entail disqualification of candidature, debar from future exams and legal action against the candidate.

BE 004

SEAL

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- The type of bond in a brick masonry containing alternate course of stretchers and headers is called
 (a) ☒ Flemish bond (b) English bond
 (c) Stretcher bond (d) Header bond
- The unit of moment of inertia of an area is
 (a) Kg/m (b) Kg/sq.m
 (c) ☒ m⁴ (d) m³
- A steel rod of 30 mm diameter and 3 m length is subjected to an axial pull of 50 kN. If $E = 200 \times 10^9$ pa, the elongation of the rod will be
 (a) 2.225 mm (b) 1.062 mm
 (c) 0.525 mm (d) ☒ 3.152 mm

$$\Delta = \frac{PL}{AE} = \frac{50 \times 10^3}{\frac{\pi}{4} \times 0.03^2 \times 200 \times 10^9}$$

$$d = 30 \text{ mm}$$

$$L = 3 \text{ m}$$

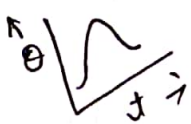
$$P = 50 \text{ kN}$$

$$\frac{3 \phi}{100 \phi}$$

$$100) 3 \phi \cdot 03$$
- The shape of the bending moment diagram over the length of a beam, carrying a uniformly increasing load is always
 (a) Linear (b) Parabolic
 (c) ☒ Cubic (d) Circular
- Every material obeys Hooke's law within its
 (a) Dimensional limit (b) Plastic point
 (c) ☒ Limit of proportionality (d) Failure limit
- An ideal flow of a liquid obeys
 (a) Continuity equation (b) Newton's law of viscosity.
 (c) ☒ Newton's second law of motion (d) Dynamic viscosity law

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7. A pipe contains an oil of specific gravity 0.9. A differential manometer connected at the two points A and B shows a difference in mercury levels as 15 cm. The difference of pressure at the two points A and B will be (Note : consider the density of mercury as 13600 kg/m³)
- (a) 18688 N/m² ☒ (b) 15981 N/m²
(c) 288 N/m² (d) 6528 N/m²
8. Hydrograph is a representation of:
- (a) Surface run off (b) Ground water flow.
(c) Rain fall ☒ (d) Discharge flow in the river
9. The quantity of water retained by the subsoil against gravity is known as:
- (a) Yield (b) Porosity
☒ (c) Specific yield ☒ (d) Specific retention
10. A soil has a bulk density of 2.3 g/cm³ and water content 15%, the dry density of soil sample is
- ☒ (a) 2.0 g/cm³ (b) 1.5 g/cm³
(c) 1.0 g/cm³ (d) 2.5 g/cm³
11. The seepage exit gradient in a soil is the ratio of :
- (a) Total head to the length of the seepage
(b) Flow line to slope
(c) Head upstream to that at downstream
☒ (d) Head loss to the length of the seepage
12. A phreatic line is defined as the line within a dam below which there are:
- (a) Positive equipotential lines ☒ (b) Positive hydrostatic pressure
(c) Negative hydrostatic pressure (d) Negative equipotential lines

$\rho_1 g h = \rho_2 g h$
 $p_1 - p_2 =$


$\gamma_d = \frac{\gamma_s}{1 + w}$
 $= \frac{2.3}{1 + 0.15}$
 $= \frac{2.3}{1.15} = 2$
 $i = \frac{h_L}{L}$
 $= \frac{2.3}{1.15} = 2$

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13. A saturated soil sample has water content of 40% and specific gravity of soil particle is 2.7. The void ratio of the soil is

(a) 0.4
☒ (c) 1.08
 (b) 0.52
 (d) 2.0

$$e = \frac{G_s \cdot w}{S_r - 1}$$

$$e = \frac{2.7 \times 0.40}{1 - 0.40}$$

$$\begin{array}{r} 2.70 \\ 0.40 \\ \hline 1.08 \end{array}$$

14. Separation of coarse aggregates from mortar during transportation, is known as

(a) Bleeding
☒ (c) Segregation
 (b) Creeping
 (d) Shrinkage

15. The high strength of rapid hardening cement at early stage is due to its:

(a) Addition of gypsum
 (b) Burning at high temperature
☒ (c) Higher content of tri-calcium silicate
 (d) Reduced lime cement

16. If d and n are the effective depth and depth of the neutral axis respectively of a singly reinforced beam, the lever arm of the beam is:

(a) d
 (b) n
 (c) $d + n/3$
☒ (d) $d - n/3$

17. Minimum spacing between horizontal parallel reinforcement bars of different diameters inter alia should not be less than:

(a) One diameter of thinner bar
 (b) One diameter of a thicker bar
☒ (c) Sum of the diameters of the thinner and thicker bars
 (d) Twice the diameter of the thinner bar

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18. The characteristic load means the value of the load:
- (a) ☒ Below which not more than 5% of the results are expected to fall
 - (b) Which has a 95% probability of not being exceeded during the life of the structure
 - (c) Which has been factored with partial safety factor
 - (d) Which has a probability of being exceeded during the life of the structure
19. Upon mixing water to the concrete ingredients, hydration takes place. The correct sequence of stages of hydration process are:
- (a) Hardening, setting, loss of workability
 - (b) Loss of workability, setting, hardening
 - (c) ☒ Setting, loss of workability, hardening
 - (d) Hardening, loss of workability, setting
20. A column splice is used to increase:
- (a) ☒ Length of the column
 - (b) Strength of the column
 - (c) Cross sectional area of the column
 - (d) Connection with the slab
21. The distance travelled by a moving vehicle during perception and brake reaction time is known as
- (a) Sight distance
 - (b) Stopping distance
 - (c) ☒ Lag distance
 - (d) Permissible distance
22. Maximum super elevation on hill roads not bound by snow should not exceed:
- (a) 5%
 - (b) 7%
 - (c) 8%
 - (d) ☒ 10%

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23. The time by which an activity completion time can be delayed without affecting the early start of the succeeding activities is known as:
- (a) Duration (b) Total float
~~(c) Free float~~ (d) Interfering float
24. One Newton's force produces an acceleration of
- (a) 1 cm / sec² while acting on a body of 1 gm mass
~~(b) 1 cm / sec² while acting on a body of 1 kg mass~~
(c) 1 m / sec² while acting on a body of 1 kg mass
(d) 1 m / sec² while acting on a body of 1 gm mass
25. Effective buckling length of a steel angle connected by double rivets is
- (a) 0.7 L ~~(b) 0.85 L~~
(c) L (d) 1.3 L
26. Web crippling in a steel structure is on account of:
- (a) column action of web
~~(b) failure of web under concentrated load~~
(c) excessive bending moment
(d) secondary bending moment
27. The self-weight of a steel roof truss in N/m² may be computed by: (span = l)
- (a) $(l/3) + 5$ (b) $[(l/3) + 5] \times 10$
(c) $(l/3) - 5$ ~~(d) $[(l/3) - 5] \times 10$~~
28. A 40 cm diameter circular timber column is 4m long. The slenderness ratio of the column is
- (a) 4 ~~(b) 10~~
(c) 20 (d) 40
- Handwritten notes:*
 $(l/3 - 5) \times 10$
 $\frac{40}{100} \times 100$
 $\lambda = \frac{l_{eff}}{r_{min}} = \frac{4m}{0.254} = 15.75$

29. For a given aggregate ratio, increasing water cement ratio:
- Increases strength
 - Decreases shrinkage
 - ☒ Increases shrinkage
 - Does not make any change in any parameter
30. General ratio of cement: sand: aggregate in nominal mix M20 grade concrete is:
- 1 : 2 : 4
 - ☒ 1 : 1.5 : 3
 - 1 : 3 : 6
 - 1 : 1 : 2
31. Which of the following is not considered in the design of the isolated footings?
- Bending moment
 - Shear
 - Punching stress
 - ☒ Torsion
32. In limit state method of design approach, spacing of main reinforcement primarily controls:
- collapse
 - ☒ cracking
 - deflection
 - Durability
33. The angle of dip at pole is :
- ☒ 0°
 - 90°
 - 45°
 - 30°
34. If the reduced bearing of line AB is N 30° W and length is 100m, then the latitude and departure respectively of the line AB will be:
- +86.6 m, +50 m
 - +50 m, +86.6 m
 - +86.6 m, -50 m
 - 86.6 m, +50 m

35. A circular curve has 300m radius and 60 degree deflection angle. The length of curve and tangent length respectively are:

- (a) 200 m, 150 m (b) 314.16 m, 173.21 m
 (c) 305.68 m, 158.73 m (d) 450 m, 220 m

$$L = 2R \sin \frac{\Delta}{2}$$

$$L = 2 \times 300 \times \sin \frac{60}{2}$$

$$L = 600 \times \sin 30$$

$$L = 600 \times \frac{1}{2}$$

$$L = 300$$

$$T = R \tan \frac{\Delta}{2}$$

$$T = 300 \times \tan 30$$

$$T = 300 \times \frac{1}{\sqrt{3}}$$

$$T = 173.21$$

36. The ranging operation in survey is a process of

- (a) Reconnaissance
 (b) Judging the distance
 (c) Establishing intermediate points between terminals
 (d) Determination of slope

37. Zenith is the point on the celestial sphere :

- (a) Just below the observer's station
 (b) Just above the observer's station
 (c) Just on the left of the observer's station
 (d) None of the above

$$\begin{array}{r} 5.04 \\ 6.14 \\ \hline 20.16 \\ 5.04 \\ \hline 30.96 \\ 30.96 \\ \hline 30.96 \end{array}$$

38. The fineness modulus of fine aggregate is 2.78 and of coarse aggregate is 7.82 and the desired fineness modulus of mixed aggregate is 6.14. What is the amount of fine aggregate to be mixed with one part of coarse aggregate?

- (a) 55% (b) 50%
 (c) 45% (d) 40%

$$\frac{F_{m \text{ coarse}} - F_{\text{combined}}}{F_{m \text{ fine}} - F_{\text{coarse}}} = \frac{7.82 - 6.14}{7.82 - 2.78}$$

$$6.14 = \frac{7.82 - x}{7.82 - 2.78}$$

39. In what context is the slump test performed?

- (a) Strength of concrete
 (b) Workability of concrete
 (c) Water-cement ratio
 (d) Durability of concrete

$$6.14 = \frac{7.82 - x}{7.82 - 2.78}$$

$$6.14 = \frac{7.82 - x}{5.04}$$

$$7.82 - x = 5.04 \times 6.14$$

$$7.82 - x = 30.96$$

$$-x = 30.96 - 7.82$$

$$-x = 23.14$$

$$x = 23.14$$

$$\frac{7.82}{2.78} = 2.81$$

40. What is the ratio of flexural strength (f_{cr}) to the characteristic compressive strength of concrete (f_{ck}) of M25 grade concrete?

- (a) 0.08
(c) 0.14

- (b) 0.11
(d) 0.17

$$f_{cr} = 0.7 \times \sqrt{f_{ck}}$$

$$EC = 5000$$

$$f_{cr} = 0.7 \times \sqrt{25}$$

$$= 0.7 \times 5$$

$$= 3.5$$

$$EC = \frac{5000}{25000}$$

41. Which of the following tests compares the dynamic modulus of elasticity of samples of concrete?

- (a) Compression test
(b) Ultrasonic pulse velocity test
(c) Split test
(d) Tension test

$$E = 2G(1 + \mu)$$

$$E = 3K(1 - 2\mu)$$

42. The bulk modulus of elasticity of a material is twice its modulus of rigidity. The Poisson's ratio of the material is

- (a) 1/7
(c) 3/7

- (b) 2/7
(d) 4/7

43. Two planks each of 50 mm × 50 mm section are glued together along the length to form a section 50 mm × 100 mm and used as a beam. If the shear force at a section is 1000 N, what is the maximum shear stress on the glue?

- (a) 0.15 MPa.
(c) 0.6 MPa.

- (b) 0.3 MPa.
(d) 2.4 MPa.

$$\tau_v = \frac{VQ}{bd}$$

$$= \frac{1000}{0.05 \times 0.10}$$

44. At a certain point in a structural member, there are perpendicular stresses 80 N/mm² and 20 N/mm², both tensile. What is the equivalent stress in simple tension, according to the maximum principal strain theory? (Poisson's ratio = 0.25)

- (a) Zero
(c) 60 N/mm²

- (b) 20 N/mm²
(d) 75 N/mm²

$$\sigma_x = \frac{6\sigma_1 - 4\sigma_2}{2}$$

$$= \frac{6 \times 80 - 4 \times 20}{2}$$

$$= \frac{480 - 80}{2}$$

$$= \frac{400}{2}$$

$$= 200$$

$$0.25 \times 10$$

$$= 2.5$$

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45. Two simply supported beams are made up of the same material and are of the same cross section. Both beams carry uniformly distributed loads of equal intensities. One beam is 2 m long and the other is 4 m long. The 2 m long beam shows a central deflection of 1 mm. What is the central deflection of the 4 m long beam?
- (a) 16 mm (b) 2 mm
(c) 8 mm (d) 1 mm
46. When the ratio of the long to short dimension of the slab is greater than X, the slab shall be designed as one-way slab, where X is
- (a) 1.1 (b) 1.5
(c) 1.8 (d) 2.0
47. A reinforced concrete cantilever porch has thickness t . The main reinforcement steel will be placed:
- (a) At mid-thickness (b) At $t/3$ from the top
(c) Close to the bottom surface (d) Close to the top surface
48. A purely cohesive soil was tested by unconfined compression test. The mean unconfined compression strength was obtained as 50 kN/ sq.m. The net ultimate bearing capacity of the soil adopting terzaghi's concept will be (adopt bearing capacity factor = 5.7, 1 kg approximately equal to 10 N).
- (a) 90 kN/ sq.m (b) 120 kN/ sq.m
(c) 142.50 kN/ sq.m (d) 162.50 kN/ sq.m
49. Web buckling occurs in a beam due to excessive
- (a) Direct tensile stress in the web
(b) Bending tensile stress in the web
(c) Torsional shear stress in the web
(d) Compressive stress in the web

$$\delta = \frac{PL^3}{48EI}$$

$$= \frac{P \times 4^3}{48EI} = \frac{P \times 64}{48EI} = \frac{4}{3} \times \frac{PL^3}{48EI}$$

$$C = \frac{5.7}{2.5} = 2.28$$

$$1.1 \times 2.28 = 2.50$$

50. In an isolated reinforced concrete footing of effective depth d , the stress in punching shear is checked
- at the centre of the column
 - at the face of the column
 - ☒ at a distance $d/2$ away from the face of the column
 - at a distance $d/2$ away from the centre of the column
51. An ISJC 200 channel section has the following details: width of flange 70 mm, depth of channel 200 mm, thickness of flange $t_f = 7.1$ mm, moment of inertia $I_{xx} = 1161.2 \text{ cm}^4$. The distance of shear centre from centre of the web will be
- 16.82 mm
 - 18.58 mm
 - 22.87 mm
 - 27.87 mm
52. Relative humidity is:
- The relative mass of water vapour per unit volume of space
 - The mass of water vapour per unit mass of moist air
 - The % ratio of the amount of moisture in a given space to the amount which that volume could contain if it were saturated
 - ☒ The humidity at which air becomes saturated when cooled under constant pressure and with constant water vapour content
53. As per the Indian Standard specification for drinking water (IS 10500 : 2012), what is the maximum acceptable limit of Fluoride (as F), in mg/l:
- 0.03
 - 0.70
 - ☒ 1.00
 - 30
54. A trapezoidal channel with base of 6 m and side slope of two horizontal to one vertical conveys water at $17 \text{ m}^3/\text{sec}$ with a depth of 1.5 m. The flow situation in the channel is:
- critical
 - ☒ supercritical
 - subcritical
 - none of the above

55. Consider the following statement associated with critical path :

1. Critical path is the most important sequence of activities which has no float and which determine the project completion period
2. Critical path is the largest path with shortest duration within which the project can be completed
3. The difference between early start time and late finish time must be equal to the activity duration
4. Cannot pass through dummy activity

Which is among the above are correct statements?

- | | |
|----------------|-------------------|
| (a) 1, 2 and 4 | (b) 1, 2 and 3 |
| (c) 1, 3 and 4 | (d) 1, 2, 3 and 4 |

56. Peak Gust wind speed as per IS 875 (Part 3) – 2015, for design loads is defined as:

- (a) Wind speed associated with maximum wave length
- (b) Wind speed associated with maximum frequency and velocity
- (c) Wind speed associated with maximum amplitude
- (d) Wind speed associated with maximum amplitude and wave length

57. As per IS 875 (part-3) : 2015, while considering the wind load acting in direction normal to the individual structural element or cladding unit, the following is not considered:

- (a) Material density coefficient
- (b) Internal and external pressure coefficients
- (c) Surface area
- (d) Design wind pressure

58. As per Indian Standards, linear dynamic analysis shall be performed to obtain the design lateral force for all buildings other than:

- (a) Rectangular buildings lower than 15 m in seismic zone I.
- (b) Regular buildings lower than 15 m in seismic zone II
- (c) Regular buildings lower than 10 m in seismic zone II
- (d) Rectangular buildings lower than 10 m in seismic zone I

59. A tube of aluminum of 40 mm external diameter and 20 mm internal diameter is snugly fitted on a solid steel rod of 20 mm diameter. The composite bar is subjected to an axial compressive force P . If the stress on steel bar is 70 N/mm^2 , the stress in the aluminum tube and corresponding value of P will be: (E for steel: $2 \times 10^5 \text{ N/mm}^2$ and E for aluminum $7 \times 10^4 \text{ N/mm}^2$)
- (a) 24.5 N/mm^2 , 45.08 kN
 (b) 36.5 N/mm^2 , 60.10 kN
 (c) 54.5 N/mm^2 , 73.10 kN
 (d) 73.80 N/mm^2 , 92.60 kN
60. A timber beam of rectangular section of length 8 m is simply supported. The beam carries a uniformly distributed load of 12 kN/m , over the entire length and a point load of 10 kN at 3 m from the left support. If the depth is two times the width and stress in the timber is not to exceed 10 N/mm^2 , what is the suitable depth of the section?
- (a) 412 mm (b) 512 mm
 (c) 612 mm (d) 712 mm
61. While aligning a hill road with a ruling gradient of 6%, a horizontal curve of radius 75 m is encountered, necessitating grade compensation. The compensated gradient at the curve will be
- (a) 3.0% (b) 3.5%
 (c) 4.5% (d) 5.0%
62. If the average sewage from a city is $95 \times 10^6 \text{ l/day}$ and the average five-day BOD is 300 mg/l , the population equivalent of the city is : (assume 5 day BOD per capita at $20^\circ\text{C} = 0.075 \text{ kg/day}$)
- (a) 2,10,000 (b) 3,80,000
 (c) 5,10,000 (d) 6,25,000

Handwritten calculation for question 61:

$$G_s = \left\{ \left(\frac{30 + R}{R} \right), \frac{75}{R} \right\} \text{ mm}$$

$$= \left\{ \frac{30 + 25}{25}, \frac{75}{25} \right\} = \left\{ \frac{55}{25}, 3 \right\} = \left\{ 2.2, 3 \right\}$$

Result: 4.5%

63. A pipe 1500 m long and 200 mm in diameter is laid at a slope of 1 in 200 for the first half length and a slope of 1 in 100 for the second half length. The pressure at the upper and lower ends are respectively 1 kg/cm² (98.1 kN/m²) and 0.5 kg/cm² (49.05 kN/m²). If coefficient of friction $f = 0.04$, the discharge in cum/ sec will be

- (a) 0.0324 (b) 0.0415
(c) 0.0489 (d) 0.0521

64. In an unconfined compression test, a sample clay 100 mm long and 50 mm in diameter fails under a load of 150 N at 10% strain. What is the shearing resistance taking into account the effect of change in cross section of the sample?

- (a) 0.068 N/mm² (b) 0.088 N/mm²
(c) 0.034 N/mm² (d) 0.044 N/mm²

65. The density of a fully saturated specimen of clay having a water content of 40% is 1.88 gm/cc. On oven drying, the density drops to 1.74 gm/cc. The shrinkage limit of the specimen will be (adopt $\rho_w = 1.0$ gm/cc)

- (a) 13.12% (b) 16.18%
(c) 22.99% (d) 26.88%

Handwritten calculations for Question 65:

$$w = 0.40$$

$$\frac{1.88 - 1.74}{1.74} = \frac{0.14}{1.74} = 0.08046$$

$$\frac{0.14}{1.74} = \frac{0.14 \times 100}{1.74} = \frac{14}{1.74} = 8.046\%$$

66. A camera equipped with a 152 mm focal length lens is used to take a vertical photograph from a flying height of 2780 m above mean sea level. If the terrain is flat and located at an elevation of 500 m, the scale of the photograph will be,

- (a) 1 : 15000 (b) 1 : 20000
(c) 1 : 22000 (d) 1 : 24500

Handwritten calculations for Question 66:

$$\frac{152}{2780 - 500} = \frac{152}{2280} = \frac{1}{15}$$

67. Rain fall intensities in mm/hr at half an hour interval during a 4-hour storm were : 5, 9, 20, 13, 6, 8, 16 and 3 mm/hr. If the corresponding observed runoff is 27.45 million m³ from a basin having an area of 1830 Km²? The ϕ -index for storm is
- (a) 6.25 mm/hr (b) 6.7 mm/hr
 (c) 7.2 mm/hr (d) 7 mm/hr
68. An activated sludge tank is 30 m long 9 m wide and has liquid depth of 4m. The influent sewage flow rate is 3.5 MLD. The primary effluent has BOD of 130 mg/l and suspended load of 15 mg/l. The MLSS concentration in the aeration tank is 1800 mg/l. The Corresponding F/M ratio is
- (a) 0.19 (b) 0.23
 (c) 0.32 (d) 0.46
69. As per BIS 456-2000, deformed bars may be used without end anchorage provided
- (a) Minimum spacing between the adjacent rod is ensured
 (b) Sufficient cover is provided to the reinforcement bars
 (c) Development length required is satisfied
 (d) None of the above
70. A propped cantilever beam of length L is subjected to a moment M at the propped end. The support moment at the fixed end will be
- (a) M (b) M/2
 (c) M/3 (d) 2 M
71. Consider a 3×3 real symmetric matrix A such that the two of its Eigen values are $a \neq 0$ and $b \neq 0$ with respective Eigen vectors $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$, $\begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix}$. If $a \neq b$, then $x_1 y_1 + x_2 y_2 + x_3 y_3$ equals
- (a) a (b) b
 (c) ab (d) 0

72. The area enclosed between the parabola $y = x^2$ and the straight line $y = x$ is
- (a) $1/8$ (b) $1/6$
(c) $1/3$ (d) $1/2$
73. The right circular cone of largest volume that can be enclosed by a sphere of 1 m radius has a height of
- (a) $1/3$ m (b) $2/3$ m
(c) $11/3$ m (d) $4/3$ m
74. Consider the function $f(x) = 2x^3 - 3x^2$ in the domain $[-1, 2]$. The global minimum of $f(x)$ is:
- (a) -5 (b) 0
(c) -1 (d) -7
- Handwritten calculations for Q74:
- $$f'(x) = 6x^2 - 6x$$
- $$f''(x) = 12x - 6$$
- $$f''(-1) = -12 - 6 = -18$$
- $$f(2) = 2(8) - 3(4) = 16 - 12 = 4$$
75. The solution of $x \frac{dy}{dx} + y = x^4$ with the condition $y(1) = 6/5$ is:
- (a) $y = \frac{x^4}{5} + \frac{1}{x}$ (b) $y = \frac{4x^4}{5} + \frac{4}{5x}$
(c) $y = \frac{x^4}{5} + 1$ (d) $y = \frac{x^4}{5} + 4$
76. The inverse Laplace transform of the function $F(S) = \frac{1}{S(S+1)}$ is
- (a) $1 - e^{-t}$ (b) $e^{-t} \sin t$
(c) e^{-t} (d) $\sin t$

77. Laplace transform of $e^{-2t} \cos(4t)$ is

(a) $\frac{s-2}{(s-2)^2+16}$

☒ (c) $\frac{s-2}{(s+2)^2+16}$

(b) $\frac{s+2}{(s-2)^2+16}$

(d) $\frac{s+2}{(s+2)^2+16}$

78. A box contains 2 washers, 3 nuts and 4 bolts. Items are drawn from the box at random, one at a time without replacement. The probability of drawing 2 washers first followed by 3 nuts and subsequently the 4 bolts is:

(a) $2/315$

☒ (c) $1/1260$

(b) $1/630$

(d) $1/2520$

79. Consider an unbiased cubic dice with opposite faces coloured identically and each face coloured red, blue and green such that each colour appears only two times on the dice. If the dice is thrown thrice, the probability of obtaining red colour on the top face of the dice at least twice is:

(a) $7/27$

☒ (c) $19/27$

(b) $10/127$

(d) $1/3$

80. The argument of the complex number $\frac{1+i}{1-i}$, where $i = \sqrt{-1}$, is

(a) $-\pi$

(c) $\pi/2$

☒ (b) $-\pi/2$

(d) $\pi/3$