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PTQ

**Prelims
Through
Questions**

for

ESE 2021

General Studies & Engineering Aptitude

Day 8 of 11

Q.321 - Q.360

(Out of 500 Questions)

Basics of Material Science + Basics of Project Management

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Q.321 Which type of bonding exists between water molecules in ice?

- (a) Covalent bond (b) Ionic bond
(c) Hydrogen bond (d) Metallic bond

321. (c)

Q.322 Consider the following statements about creep:

1. Low melting point materials can easily undergo creep at high temperature.
2. Creep curve is a plot between strain versus temperature.
3. Creep deformation is non-recoverable.

Which of the above statements are correct?

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

322. (d)

Creep curve is a plot between strain versus time.

Q.323 Which of the following is Teflon?

- (a) Polyethylene (b) Polytetrafluoroethylene
(c) Polyvinylchloride (d) Polyacrylonitrile

232. (b)

Q.324 A magnetizing field of 2000 A/m produces a magnetic flux of 2×10^{-5} wb in a bar of iron of 0.2 cm^2 cross section. Then the permeability of the bar is

- (a) $0.5 \times 10^{-3} \text{ N/A}^2$ (b) $2 \times 10^3 \text{ N/A}^2$
(c) $2 \times 10^{-3} \text{ N/A}^2$ (d) $0.5 \times 10^3 \text{ N/A}^2$

324. (a)

$$H = 2 \times 10^3 \text{ A/m}, \phi = 2 \times 10^{-5} \text{ wb}$$

$$\text{Magnetic flux density, } B = \frac{\phi}{A} = \frac{2 \times 10^{-5}}{0.2 \times 10^{-4}} = 1 \text{ wb/m}^2$$

$$\text{Permeability, } \mu = \frac{B}{H} = \frac{1}{2 \times 10^3} = 0.5 \times 10^{-3} \text{ N/A}^2$$

Q.325 A superconducting material on being subjected to the critical magnetic field, the material

- (a) remains unaffected
(b) changes from type-1 to type-2 superconductor
(c) goes into the state of superconductivity which is independent of temperature
(d) will come to normal state from superconducting state

325. (d)

Superconducting material on being subjected to the critical field, the material will come to normal state.

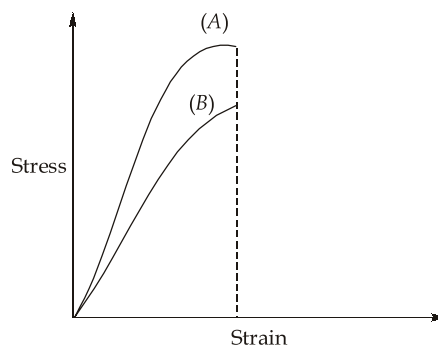
Q.326 Orientational polarisation

- (a) varies exponentially with temperature
- (b) varies linearly with temperature
- (c) varies inversely with temperature
- (d) is independent of temperature

326. (c)

The alignment of the dipoles is also temperature dependent and increases if the temperature of specimen is lowered.

Q.327 The stress-strain curve for two materials A and B upto yield point is shown below:



Based on the above schematic representations, which material is more ductile?

- (a) Material (A)
- (b) Material (B)
- (c) Both have equal ductility
- (d) Data insufficient

327. (d)

Ductility is a measure of the degree of plastic deformation that has been sustained at fracture. In question, there is no information given about fracture, so we cannot predict about ductility of two materials.

Q.328 Which of the following statements are correct regarding magnetic materials?

1. Retentivity is the measure of the magnetic field strength required to destroy the residual magnetism in the material.
2. Coercivity is the measure of the magnetic flux density remaining in the material when the magnetizing field is removed.

Select the correct answer using the codes given below:

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

328. (d)

Retentivity: The measure of the magnetic flux density remaining in the material when the magnetizing field is removed.

Coercivity: Measure of the magnetic field strength required to destroy the residual magnetism in the material.

Q.329 Density of electrons in the conduction band of semiconductor:

- (a) increases linearly with increase in temperature
- (b) decreases linearly with increase in temperature

- (c) increases exponentially with increase in temperature
(d) decreases exponentially with increase in temperature

329. (c)

The density of electrons in the conduction band, density of holes in the valence band increases exponentially with increase in temperature.

Q.330 If the atomic radius of gold is r , what is its unit cell volume?

- (a) $\left(\frac{4r}{\sqrt{4}}\right)^3$ (b) $\left(\frac{4r}{\sqrt{3}}\right)^3$
(c) $\left(\frac{4r}{\sqrt{2}}\right)^3$ (d) $\left(\frac{2r}{\sqrt{3}}\right)^3$

330. (c)

Gold has FCC crystal structure.

For FCC crystal structure, $\sqrt{2}a = 4r$

$$a = \frac{4r}{\sqrt{2}}$$

$$\therefore \text{Volume, } a^3 = \left(\frac{4r}{\sqrt{2}}\right)^3$$

Q.331 Which of the following bonding is directional in nature?

- (a) Ionic bonding (b) Metallic bonding
(c) Covalent bonding (d) None of the above

331. (c)

- Covalent bonds are very strong and directional in nature.
- Ionic and metallic bonding are non-directional in nature.

Q.332 Consider the following relations between atomic radius(r) and lattice constant (a) for the given crystal

1. Simple cubic crystal: $a = 2r$
2. Body centered cubic crystal: $a = \frac{4}{\sqrt{3}} r$.
3. Face centered cubic crystal: $a = 2\sqrt{3} r$.

Which of the above given relations are correct?

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

332. (a)

Simple cubic crystal: $a = 2r$

$$\text{BCC : } a = \frac{4}{\sqrt{3}} r$$

$$\text{FCC : } a = 2\sqrt{2}r$$

Q.333 Concrete is an example of

- (a) micro composites (b) continuous fibre composites
(c) large particle composites (d) short fibre composites

333. (c)

Q.334 Which of the following is the correct combinations of properties of ceramics?

- (a) high strength, high hardness, high creep resistance and low toughness
(b) high strength, high hardness, high creep resistance and high toughness
(c) low strength, low hardness, low creep resistance and low toughness
(d) high strength, high hardness, low brittleness and high toughness

334. (a)

Q.335 Consider the following statements about Diamond:

1. Diamond crystal structure is a variant of zinc blende.
2. Diamond has very low thermal conductivity and very high electrical conductivity.

Which of the above statements is/are correct?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

335. (a)

- Diamond crystal structure is a variant of zinc blende, in which Carbon atoms occupy all positions (both Zn and S).
- Diamond has very high thermal conductivity and very low electrical conductivity.

Q.336 Which of the following defects has a specific mirror lattice symmetry?

- (a) Tilt boundaries (b) Twin boundaries
(c) Stacking faults (d) Screw dislocation

336. (b)

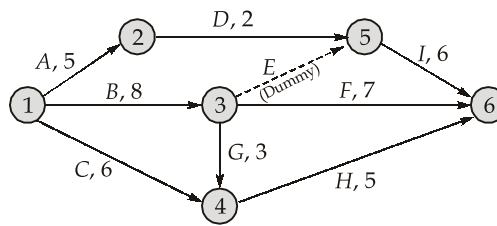
Q.337 Doping intrinsic silicon with arsenic as an impurity

- (a) conductivity of silicon decreases
(b) produces a semiconductor in which the charge carriers are predominantly electrons but holes are also present
(c) produces a semiconductor in which the charge carriers are predominantly holes but free electrons also present.
(d) produces a semiconductor in which the charge carriers contain nearly equal number of electrons and holes.

337. (b)

Arsenic is pentavalent impurity so n-type semiconductor will be produced.

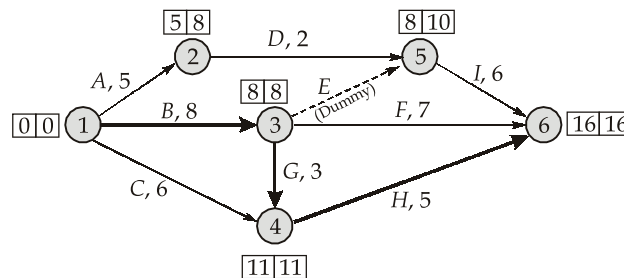
Q.338 The given network has the estimated duration for each activity marked as shown below:



The total duration to finish the project is

- (a) 13 days
- (b) 14 days
- (c) 15 days
- (d) 16 days

338. (d)



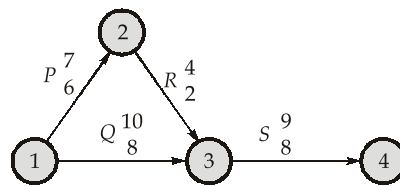
Q.339 If Net Present Value (NPV) is less than zero, then

- (a) Project is financially viable
- (b) Project just meets breakdown
- (c) Project is not financially viable
- (d) None of the above

339. (c)

If $NPV < 0$, then project is not financially viable.

Q.340 Consider the following network diagram:



Where X_j^i (i - Normal duration, j - Crash duration)

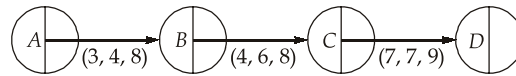
Which activity is to be crashed after R is crashed for 1 day?

- (a) R only
- (b) Combinations of R and Q
- (c) S only
- (d) Depends on cost slope analysis

340. (d)

After R has been crashed for 1 day either R and Q combination could be crashed or S could be crashed that all depends which cost slope combination would be least.

Q.341 The optimistic, most likely and pessimistic time (in days) estimates for the PERT network of a project are shown in the given figure. The expected duration of the project is



- (a) 14 days
(b) 17 days
(c) 17.83 days
(d) 18.67 days

341. (c)

For activity AB, $t_{e_1} = \frac{t_o + 4t_m + t_p}{6} = \frac{3 + 4(4) + 8}{6} = 4.5$ days

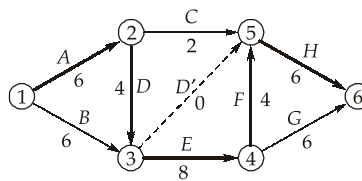
For activity BC, $t_{e_2} = \frac{4 + 4 \times 6 + 8}{6} = 6$ days

For activity CD, $t_{e_3} = \frac{7 + 4 \times 7 + 9}{6} = 7.33$ days

∴ Expected duration of project

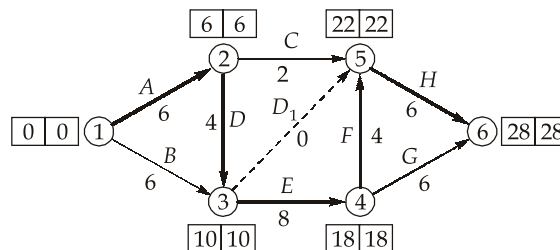
$$= t_{e_1} + t_{e_2} + t_{e_3} = 17.83 \text{ days}$$

Q.342 What is independent float for activity C?



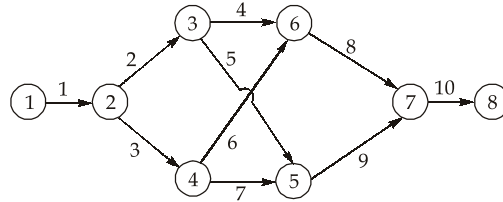
- (a) 2 days
(b) 6 days
(c) 8 days
(d) 14 days

342. (d)



$$\begin{aligned} \text{Independent float} &= \text{Free float} - \text{Interference float} \\ &= [22 - 6 - 2] - 0 = 14 \text{ days} \end{aligned}$$

Q.343 The figure below indicates a project network wherein the number at each activity represents its normal duration (in days). The critical path is along



- (a) 1 - 2 - 3 - 6 - 7 - 8 (b) 1 - 2 - 4 - 5 - 7 - 8
(c) 1 - 2 - 3 - 5 - 7 - 8 (d) 1 - 2 - 4 - 6 - 7 - 8

343. (b)

Duration along critical path (1 - 2 - 4 - 5 - 7 - 8) is 30 days.

Q.344 Consider the following statements regarding contract:

1. In lump-sum contract, in case of unforeseen hazard during the construction, contractor may be put in adverse situation.
2. In unit price contract, the price is paid per unit of the work carried out.
3. In cost plus contract, the payment is made on the work carried out plus the fee which include overhead, profit, etc.

Which of the above statement(s) is/are correct?

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

344. (d)

Q.345 A project manager is responsible for

1. Risk management 2. Quality management
3. Cost management 4. Integration

Select the correct answer using codes given below:

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

345. (d)

Q.346 The material cost of a similar construction project that was completed four years ago was Rs. 8000000 and the material cost index was 500. What will be the approximate cost for new project, if the material cost index is now 625?

- (a) Rs. 6400000 (b) Rs. 7500000
(c) Rs. 9000000 (d) Rs. 10000000

346. (d)

The approximate material cost for the new project ' C_n ' is calculated using the relationship given below:

$$C_n = \frac{C_r I_n}{I_r}$$

where,

- C_n = Present cost estimate of material
- C_r = Material cost before four years ago
- I_r = Material cost index four years ago
- I_n = Present material cost index

$$\therefore C_n = \frac{8000000 \times 625}{500} = 10000000$$

Q.347 Consider the following rules for drawing network diagram:

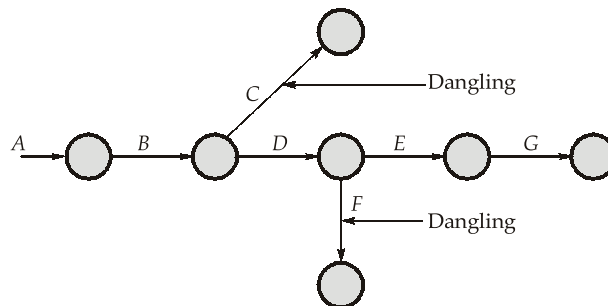
1. All activities shall be represented by straight arrows pointing always in forward direction.
2. There shall not be any criss-crossing of arrows.
3. Dummy activities shall be introduced only when it is absolutely necessary and without which the diagram cannot be completed.
4. In complex network problems, if the logical sequence of activities is not correctly followed, a dangling errors in network may introduced.

Which of the above statement(s) is/are INCORRECT?

- (a) 1 and 3 only
- (b) 3 only
- (c) 4 only
- (d) 3 and 4 only

347. (c)

In complex network problems, if the logical sequence of activities is not correctly followed, a loop network may be formed. Whenever an activity is disconnected from the network, it is a called as dangling error.



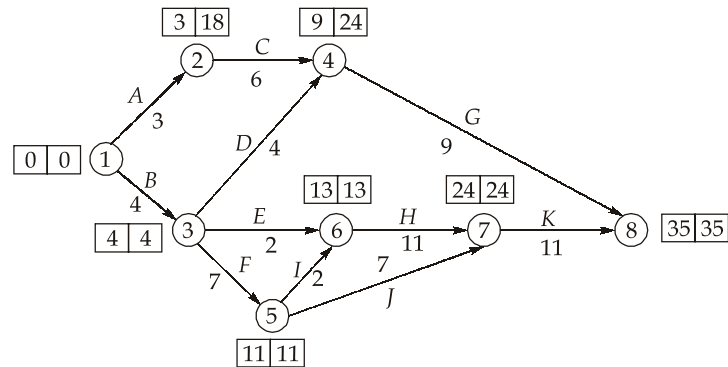
Q.348 Which one of the following statements is INCORRECT?

- (a) Cost Performance Index (CPI) of less than 1.0 indicates, that the project is spending more than the schedule cost.
- (b) A negative Schedule Variance (SV) indicates that the project is behind the schedule.
- (c) Schedule Performance Index (SPI) of less than 1.0 indicates that the progress of work performed is ahead than the schedule.
- (d) Estimate Cost Performance Index (ECPI) of less than 1.0 indicates that the amount spent on the project will be more than the budget amount.

348. (c)

Schedule Performance Index (SPI) of less than 1.0 indicates that the progress of work performed is less than the schedule.

351. (d)



Q.352 A project takes 16 days along two critical paths and has a standard deviation of 2 days and 4 days along them. What is the probability of completing the project in 20 days?

[Given : $P(Z = 1) = 84.13\%$, $P(Z = 2) = 97.72\%$]

- (a) 50% (b) 84.13%
(c) 99.86% (d) 97.72%

352. (b)

$$Z = \frac{T_S - T_E}{\sigma}$$

For completion, maximum standard deviation will be considered.

$$\therefore Z = \frac{20 - 16}{4} = 1$$

Probability for $(Z = 1) = 84.13\%$

Q.353 Consider the following statements regarding the Net Present Value (NPV):

1. It computes the net present value of the cash inflow in each of the future year.
2. Proposals can be ranked in ascending order of the NPV.
3. If $NPV < 0$, the project is financially viable.

Which of the above statement(s) is/are CORRECT?

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

353. (c)

Proposal can be ranked in descending order of the NPV. If $NPV < 0$, then project is financially not viable.

Q.354 The details of production costs and revenues of a project area as under:

Total cost	: Rs. 95,000
Fixed cost	: Rs. 55,000
Sales (8,000 units)	: Rs. 80,000

What should be the output if the profit desired is Rs. 20,000?

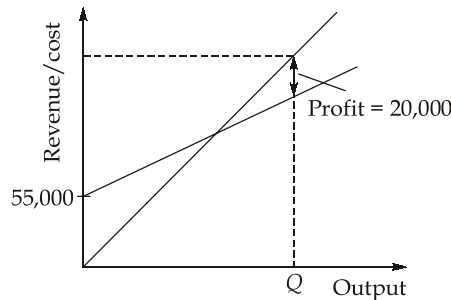
- (a) 15000 (b) 12000
(c) 9000 (d) 6000

354. (a)

$$\begin{aligned} \text{Total cost} &= \text{Rs. } 95,000 \\ \text{Fixed cost} &= \text{Rs. } 55,000 \\ \text{Sales (8,000 units)} &= \text{Rs. } 80,000 \\ \text{Variable cost} &= \text{Total cost} - \text{Fixed cost} \\ &= 95,000 - 55,000 = \text{Rs } 40,000 \end{aligned}$$

$$\text{Variable cost per unit (C)} = \frac{40,000}{8000} = 5$$

$$\text{Per unit sale value (S)} = \frac{80,000}{8000} = 10$$



Let Q be the number of units required to be produced for achieving profit of Rs. 20,000

$$\begin{aligned} \therefore 20,000 &= SQ - (FC + CQ) \\ 20,000 &= 10Q - (55,000 + 5Q) \\ 5Q &= 75,000 \\ Q &= \frac{75,000}{5} = 15,000 \end{aligned}$$

Q.355 For a project, consider the data given below:

Investment on the project : Rs. 10,00,000
Life of the project : 5 years
Cost of capital : 5%

Year	1	2	3	4	5
Cash inflow (in lakhs)	3	4	4	3	2

Net present value of the project will be (discounting rate factor for 1st, 2nd, 3rd, 4th and 5th year are 0.952, 0.907, 0.863, 0.822 and 0.784 respectively.

- (a) 5.46 lakh (b) 2.86 lakh
(c) 4.82 lakh (d) 3.97 lakh

355. (d)

Present value of future cash inflows

$$\begin{aligned} PV &= \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} + \frac{CF_4}{(1+r)^4} + \frac{CF_5}{(1+r)^5} \\ &= \frac{3}{(1+0.05)} + \frac{4}{(1+0.05)^2} + \frac{4}{(1+0.05)^3} + \frac{3}{(1+0.05)^4} + \frac{2}{(1+0.05)^5} \\ &= 3 \times 0.952 + 4 \times 0.907 + 4 \times 0.863 + 3 \times 0.822 + 2 \times 0.784 \\ &= 13.97 \text{ lakh} \end{aligned}$$

Initial investment = 10 lakh

$$\therefore \text{NPV} = \text{PV} - \text{IV} = 13.97 - 10 = 3.97 \text{ lakh}$$

Direction: The following items consists of two statements, one labelled as **Statement (I)** and the other labelled as **Statement (II)**. You have to examine these two statements carefully and select your answers to these items using the codes given below:

Codes:

- (a) Both Statement (I) and Statement (II) are true and Statement (II) is the correct explanation of Statement (I).
- (b) Both Statement (I) and Statement (II) are true but Statement (II) is not a correct explanation of Statement (I).
- (c) Statement (I) is true but Statement (II) is false.
- (d) Statement (I) is false but Statement (II) is true.

Q.356 Statement (I): Zirconium and its alloys are ductile and have other mechanical characteristics that are comparable to those of titanium alloys.

Statement (II): The only problem of using zirconium in various application is that their corrosion resistance is very low.

356. (c)

Corrosion resistance of zirconium is very high even in the host of corrosive media including superheated water.

Q.357 Statement (I): Alloying iron with silicon, is used for making core of transformer.

Statement (II): Silicon increases the resistance of magnetic material.

357. (a)

Silicon increases the resistance of magnetic material which reduces the eddy current loss of the transformer.

Q.358 Statement (I): The Miller indices of a material in a plane are proportional to reciprocal of intercept of the planes on the coordinate axes.

Statement (II): If a plane is parallel to x axes and y axes then its Miller indices can be (0 0 2).

358. (b)

Q.359 Statement (I): In a PERT network, individual activity follows normal distribution curve.

Statement (II): In a PERT network, total duration of project along critical path has 50% probability of completion.

359. (d)

In PERT analysis, individual activity follows β distribution curve.

Q.360 Statement (I): In matrix organisation, quick and effective methods for conflict resolution are not possible.

Statement (II): There is a better balance among time, cost and performance.

360. (d)

In matrix organisation, quick and effective methods for conflict resolution are possible.

■■■■