



SSC JE 2019-20

Mechanical Engineering

Mini Mock Challenge
(June 27- June 28 2020)

Questions &
Solutions

1. **In the following question, select the related word from the given alternatives.**

Japan : Yen :: Mongolia : ?

- A. Dollar
- B. Ringgit
- C. Won
- D. Togrog

Ans. D

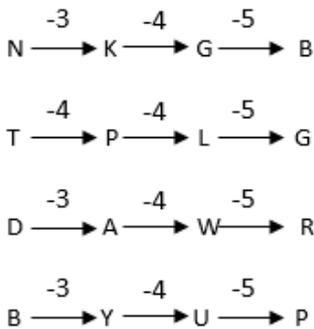
Sol. Yen is the currency of Japan. Similarly, Togrog is the currency of Mongolia. Hence, option D is the correct response.

2. **In the following question, select the odd letters from the given alternatives.**

- A. NKGB
- B. TPLG
- C. DAWR
- D. BYUP

Ans. B

Sol. As,



Thus TPLG are the odd letters. Hence, option B is correct.

3. **Arrange the given words in the sequence in which they occur in the dictionary.**

- 1) Players
 - 2) Polished
 - 3) Potash
 - 4) Plateau
 - 5) Parabola
- A. 51432
 - B. 51423
 - C. 51234
 - D. 54123

Ans. D

Sol. Alphabetical order is:

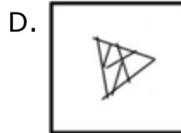
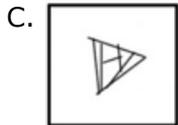
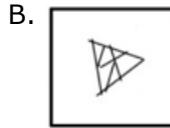
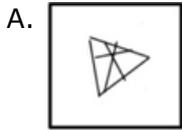
- 5. Parabola
- 4. Plateau
- 1. Players
- 2. Polished
- 3. Potash

Thus the correct sequence is 54123 Hence, option D is the correct answer.

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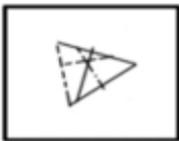
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7. From the given answer figures, select the one which is hidden/embedded in the question figure.



Ans. A

Sol. On observing the options we can see that the figure given under option (A) is indeed embedded in the original figure. It has been represented below,



hence, option A is correct.

8. In the following question, select the word which cannot be formed using the letters of the given word.

BANKRUPT

A. BURP

B. TANK

C. RUN

D. CORRUPT

Ans. D

Sol. **BANKRUPT** has BURP

BANKRUPT has TANK

BANKRUPT has RUN

CORRUPT has C which is not present in the word **BANKRUPT**.

Hence, option C is the correct answer.

9. If "÷" denotes "x", "+" denotes "÷", "x" denotes "-" and "-" denotes "+", then $33 + 11 - 8 \div 4 \times 12 = ?$

A. 108

B. 23

C. 86

D. 58

Ans. B

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Sol.

Symbol	÷	+	×	-
Meaning	×	÷	-	+

Substituting symbols with their respective operator, the equation becomes,

$$33 \div 11 + 8 \times 4 - 12$$

Applying BODMAS rule we get,

$$33 \div 11 + 8 \times 4 - 12$$

$$= 3 + 8 \times 4 - 12$$

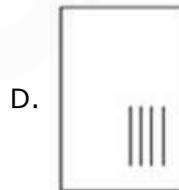
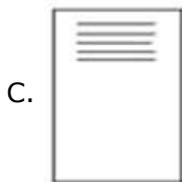
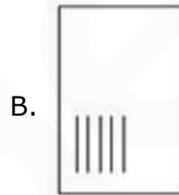
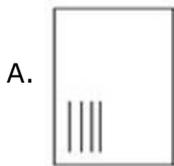
$$= 3 + 32 - 12$$

$$= 3 + 20$$

$$= 23$$

Hence, option B is the correct answer.

10. **Select the figure that will come next in the following series.**



Ans. B

Sol. After observation, it is clear that, answer figure (b) will be the next figure.

Logic- number of Straight lines increasing by +1 in each step.



Hence, option(B) is the correct answer.

11. Who among the following Mughal Emperors was called Darvesh or a Zinda Fakir?

A. Aurangzeb

B. Shah jahan

C. Humayun

D. Babur

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• **Other famous players of Tabla are-** Ustad Alla Rakha, Pandit Swapan Chaudhuri, Pandit Anindo Chatterjee Ghosh, Pandit Nayan Ghosh, Ustad Rashid Mustafa Thirakwa, Pandit Kishen Maharaj, Ustad Tari Khan, and Pandit Kumar Bose.

19. Pashupatinath temple is located in _____.

- A. Nepal
- B. India
- C. Cambodia
- D. Bangladesh

Ans. A

Sol. * Pashupatinath temple is a Hindu temple complex located on the banks of the Bagmati River in **Kathmandu, Nepal**.

* It is inscribed in UNESCO World Heritage Sites's list.

* It is dedicated to Lord Shiva.

* It was erected in the 5th century by Licchavi King Prachanda Dev.

20. Which Indian Institute has developed the first made-in-India test kit for COVID-19?

- A. ICMR
- B. Homi Bhabha Cancer Hospital & Research Centre
- C. Mylab Discovery Solutions Pvt Ltd.
- D. Punjab Institute of Medical Sciences

Ans. C

Sol. • **Mylab Discovery Solutions Pvt Ltd**, has developed the first made-in-India test kit for COVID-19.

- It is a Pune, Maharashtra-based molecular diagnostics company.
- The kit was developed in a record period of six weeks.
- The cost of a single kit is Rs.80,000 and it can test 100 patients.

21. Fins are used to increase the heat transfer from surface by _____.

- A. Increasing the temperature difference
- B. Increasing the effective surface area
- C. Increasing the convection heat transfer coefficient
- D. None of the above

Ans. B

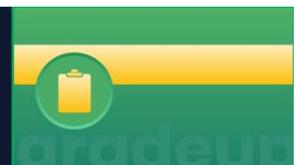
Sol. The heat flow rate to increase the heat transfer from surface by increasing the effective surface area.

22. Which of the following forces provides continuous pressure on the metal in centrifugal casting ?

- A. Spring force
- B. Centrifugal force
- C. Gravitational force
- D. Frictional force

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26. The equation $\left(P + \frac{a}{v^2}\right)(v - b) = RT$ is known as_____.

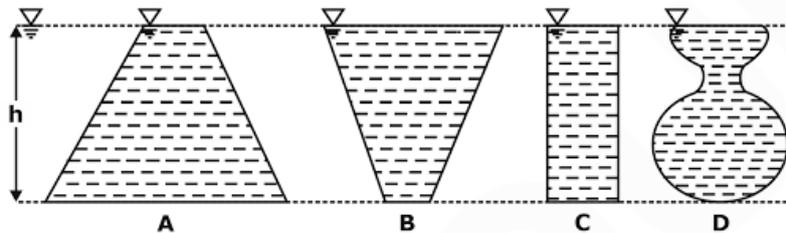
- A. Real gas equation
- B. Maxwell’s equation
- C. Vander wall’s equation
- D. Ideal gas equation

Ans. C

Sol. The van der Waals equation is a thermodynamic equation of state based on the theory that fluids are composed of particles with non-zero volumes, and subject to a (not necessarily pairwise) inter-particle attractive force.

The equation $\left(P + \frac{a}{v^2}\right)(v - b) = RT$ is known as vander wall’s equation.

27. Which container is having maximum pressure (with all having same liquid)?



- A. A & C having same pressure
- B. D
- C. Data insufficient
- D. All having same pressure

Ans. D

Sol. • The pressure at any point depends only upon the depth below the free surface and unit weight of the liquid.
• The pressure does not depend upon the size and shape of the container.
Hence, the pressure at the bottom of all containers will be same if they are filled with same liquid up to the same height.

28. Mixture of gases expands from 0.03 m³ to 0.06 m³ at a constant pressure of 1 MPa and absorbs 84 kJ of heat during the process. The change in internal energy of the mixture is_____.

- A. 30 kJ
- B. 54 kJ
- C. 84 kJ
- D. 114 kJ

Ans. B

Sol. Given,

Initial Volumn= 0.03 m³
Final Volume = 0.06 m³
Constant Pressure = 1 MPa,
Heat addition = 84 kJ,

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By first law of thermodynamic,

$$\delta Q = dU = \delta W$$

$$84 = dU + 1000 \times (0.06 - 0.03)$$

$$84 = dU + 30$$

$$dU = 54 \text{ kJ}$$

29. The value thermal conductivity of thermal insulation applied to a hollow spherical vessel containing very hot material is 0.5 W/mK. The convective heat transfer coefficient at the outer surface of insulation is 10 W/m²K. What is the critical radius of the sphere?

- A. 0.1 m
- B. 0.2 m
- C. 1.0 m
- D. 2.0 m

Ans. A

Sol. Given,

$$K_{ins.} = 0.5 \text{ W/mK}$$

$$\text{heat transfer coefficient} = 10 \text{ W/m}^2\text{K}$$

$$(r_0)_{critical} = \frac{2k}{h} (\text{For sphere})$$

$$= \frac{2 \times 0.5}{10} = 0.1 \text{ m}$$

30. A closed system undergoes a process 1-2 for which the values of Q₁₋₂ and W₁₋₂ are + 20 kJ and + 50 kJ respectively. If the system is returned to state 1 and Q₂₋₁ is -10 kJ. What is the value of the work W₂₋₁_____.

- A. + 20 kJ
- B. - 40 kJ
- C. - 80 kJ
- D. + 40 kJ

Ans. B

Sol. Law of conservation of energy,

Joule law,

$$\oint \delta Q = \oint \delta W$$

For a closed cyclic Process,

$$Q_{1-2} + Q_{2-1} = W_{1-2} + W_{2-1}$$

$$20 - 10 = 50 + W_{2-1}$$

$$W_{2-1} = - 40 \text{ kJ}$$

31. For an air-conditioned space, RTH = 100 kW, RSHF = 0.75, volume flow rate = 100 m³/min, and indoor design specific humidity is 0.01 kg/kg of dry air. What is the specific humidity of the supply air (in kg/kg of dry air)_____?

- A. 0.010
- B. 0.0075
- C. 0.005
- D. 0.0025

Ans. C

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Sol. Given,

Room Total Heat = 100 kW,

Room Sensible Heat Factor (RSHF) = 0.75,

volume flow rate = 100 m³/min,

$$RSHF = \frac{RSH}{RTH}$$

$$\therefore RSH = 0.75 \times 100 = 75 \text{ kW}$$

$$RLH = 100 - 75 = 25 \text{ kW}$$

$$RLH = 50C_{pm}\Delta\omega$$

$$= (50 \times 100 (\omega_i - \omega_s)) = 50 \times 10 \times (0.01 - \omega_s)$$

$$25 = 50 \times 10 \times (0.01 - \omega_s)$$

$$\omega_s = 0.005 \text{ kg/kg of dry air}$$

32. Fluid is flowing through the horizontal pipe of uniform diameter 500 mm with an average velocity of 1 m/sec the dynamic head of pitot tube is _____ (in mm) ?

A. 45.34

B. 50.96

C. 35.87

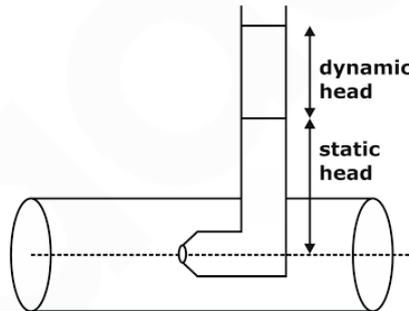
D. None of these

Ans. B

Sol. Given,

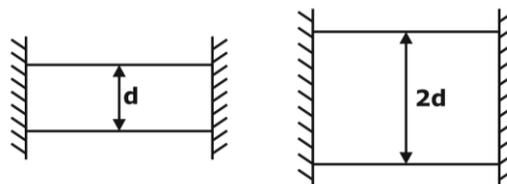
Pipe diameter = 500 mm

Average velocity = 1 m/sec



$$\text{Dynamic head} = \frac{v^2}{2g} = \frac{1^2}{2 \times 9.81} = 0.05096 \text{ m} = 50.96 \text{ mm}$$

33. There are two beams of diameter d and 2d fixed at both ends as shown in figure. Both beams are made up of same material. The ratio of thermal stress developed in beam of smaller diameter to the larger diameter for the same rise in temperature will be



A. 1/4

B. 1/2

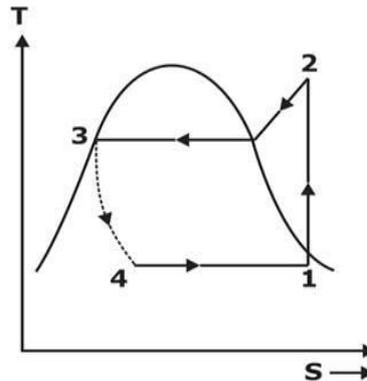
C. 1/8

D. 1

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Ans. C

Sol.



$$h_1 = 150 \text{ kJ/kg}$$

$$h_2 = 175 \text{ kJ/kg}$$

$$h_3 = h_4 = 50 \text{ kJ/kg}$$

$$\text{Refrigeration effect} = h_1 - h_4 = 100 \text{ kJ/kg}$$

$$\text{Work input} = h_2 - h_1 = 25 \text{ kJ/kg}$$

$$\text{COP} = \frac{\text{Refrigeration effect}}{\text{Work input}}$$

$$= \frac{100}{25} = 4$$

36. For a laminar flow through pipe, velocity distribution is_____.

- A. Linear
- B. Parabolic
- C. Logarithmic
- D. Constant

Ans. B

Sol. Velocity profile for a laminar flow through pipe is,

$$v = -\frac{1}{4\mu} \frac{\partial p}{\partial x} R^2 \left[1 - \frac{r^2}{R^2} \right],$$

which is parabolic in nature.

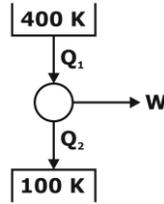
37. In a reversible heat engine the temperature limits are 100 K and 400 K.If heat output is 200 kJ and heat input is_____.

- A. 400 kJ
- B. 200 kJ
- C. 100 kJ
- D. 800 kJ

Ans. D

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Sol. For a reversible heat engine,



By Clausius Inequality,

$$\frac{Q_1}{Q_2} = \frac{T_1}{T_2}$$

$$\frac{Q_1}{200} = \frac{400}{100}$$

$$Q_1 = 800 \text{ kJ}$$

38. In a ball bearing if load is doubled then life is

- A. 8 times of initial
- B. 4 times of initial
- C. 1/8 times of initial
- D. 1/4 times of initial

Ans. C

Sol. Life of ball bearing

$$L = \left(\frac{C}{F}\right)^3$$

Give, $F_2 = 2F_1$

$$\frac{L_2}{L_1} = \left(\frac{F_1}{F_2}\right)^3$$

$$= \left(\frac{1}{2}\right)^3$$

$$= \frac{1}{8}$$

39. The angular velocity of the pinion is $\omega_p = 10.47 \text{ rad/s}$ and that of the gear is $\omega_g = 3.14 \text{ rad/s}$. The path of recess is equal to 50 mm and the path of contact = 100 mm. Find the velocity of sliding at the beginning of the contact_____.

- A. 1033.29 mm/s
- B. 902.93 mm/s
- C. 394.02 mm/s
- D. 680.58 mm/s

Ans. D

Sol. Given

Angular velocity of the pinion (ω_p)= 10.47 rad/s

Angular velocity of the pinion (ω_g) = 3.14 rad/s

Path of approach = Path of contact - Path of recess = 100 mm - 50 mm = 50 mm.

$$\begin{aligned} \text{Velocity of sliding} &= (\omega_p + \omega_g) \times \text{Path of approach} \\ &= (10.47 + 3.14) \times 50 = 680.58 \text{ mm/s.} \end{aligned}$$

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By Eqn. (1)

⇒ a_1 is less than a_2 therefore

⇒ S_1 will be larger than S_2

42. A hollow shaft of the same cross-section area and material as that of a solid shaft transmits_____

A. Same torque

B. Lesser torque

C. More torque

D. Cannot be predicted

Ans. C

Sol. Given

Cross-section area is same,

$$\frac{\pi}{4}(d_1^2 - d_2^2) = \frac{\pi}{4}d_s^2$$

$$(d_1^2 - d_2^2) = d_s^2$$

$$d_1^2 = d_s^2 + d_2^2$$

So $d_1 > d_s$

where d_1 = outer dia. of hollow shaft

d_2 = inner dia. of hollow shaft

d_s = solid shaft dia.

The given material $T \propto \frac{J}{r}$

$$\frac{T_H}{T_S} = \frac{\left(\frac{J}{r}\right)_H}{\left(\frac{J}{r}\right)_S}$$

$$= \frac{\left[\frac{d_1^4 - d_2^4}{d_1}\right]}{d_s^3}$$

since $d_1^2 - d_2^2 = d_s^2$

$$\frac{T_H}{T_S} = \frac{d_1^2 + d_2^2}{d_s d_1}$$

So $T_H > T_S$

43. In a steady fluid flow, identical ones are_____.

A. Path line and stream line

B. Stream line and streak line

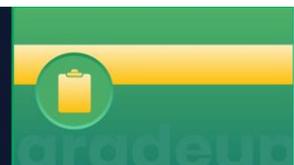
C. Path line and streak line

D. Path line, stream line and streak line

Ans. D

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Sol. All the three lines behave likely when the flow is independent of time (steady flow) as the properties such as velocity and acceleration etc. cannot be differentiated when time is not a parameter i.e. during steady flow.

44. A dummy activity _____.

- A. is artificially introduced
- B. is represented by a dotted line
- C. does not consume time
- D. all the above.

Ans. D

Sol. **Dummy Activity:**

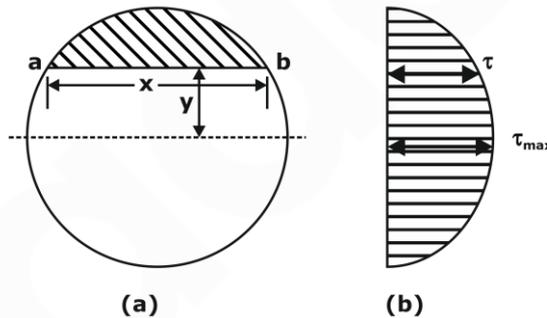
- A dummy activity is used to indicate the precedence relationship via a dashed arc. It is introduced artificially.
- A dummy activity has no duration and uses no resources.
- All of the above are correct.

45. The ratio of the maximum shear stress to average shear stress in a beam with circular cross sections is_____.

- A. 3:1
- B. 2:1
- C. 3:2
- D. 4:3

Ans. D

Sol. For a circular cross section,



$$\frac{\tau_{\max}}{\tau_{\text{avg}}} = \frac{4}{3}$$

46. Inside a ship building R&D center, a $\frac{1}{25}$ model of a ship was to be put under experimental analysis, for estimating its wave drag. If the speed the actual full scale ship is 1 m/s, then at what speed must be model must be tested?

- A. 0.04 m/s
- B. 0.2 m/s
- C. 5 m/s
- D. 25 m/s

Ans. B

Sol. Applying Froude's Model law,

$$\therefore (Fr)_m = (Fr)_m$$

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$$\therefore \frac{V_m}{\sqrt{gL_m}} = \frac{V_p}{\sqrt{gL_p}}$$

$$\text{or, } \frac{V_m}{V_p} = \sqrt{\frac{L_m}{L_p}} = \sqrt{\frac{1}{25}} = \frac{1}{5} = 0.2 \text{ m/s}$$

47. The loss of availability energy associated with the transfer of 1000 kJ of heat from a constant temperature system at 600 K to another at 400 K when the environment temperature is 300 K _____.

- A. 150 kJ
- B. 250 kJ
- C. 166.67 kJ
- D. 180 kJ

Ans. B

Sol. Given,

Heat transfer = 1000 kJ ,

High temp. = 600 K,

Low temp. = 400 K,

Loss in available energy,

$$I = T_0 (\Delta S)_{\text{universe}}$$

$$I = T_0 [(\Delta S)_{\text{sys}} + (\Delta S)_{\text{surr.}}]$$

$$I = T_0 \left[\frac{-Q}{T_1} + \frac{Q}{T_2} \right]$$

$$= QT_0 \left[\frac{-1}{T_1} + \frac{1}{T_2} \right]$$

$$= 1000 \times 300 \left[\frac{-1}{600} + \frac{1}{400} \right]$$

$$= 250 \text{ kJ}$$

48. Find the tearing efficiency if dia of rivet hole is 8 mm and pitch of rivet is 20 mm ?

- A. 0.4
- B. 0.8
- C. 0.6
- D. 0.5

Ans. C

Sol. Given,

Dia of rivet hole = 8 mm

Pitch of rivet = 20 mm

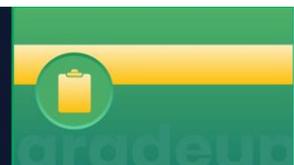
$$\eta_{\text{tearing}} = 1 - \frac{d_h}{p}$$

$$= 1 - \frac{8}{20}$$

$$= 0.60$$

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49. If the relationship between the shear stress τ and the rate of shear strain $\left(\frac{du}{dy}\right)$ is

$$\tau = \mu \left(\frac{du}{dy}\right)^n$$

Then the fluid with exponent $n > 1$ is known as which one of the following?

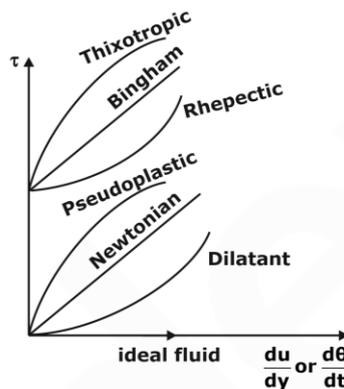
- A. Bingham plastic
- B. Dilatant fluid
- C. Newtonian fluid
- D. Pseudoplastic fluid

Ans. B

Sol. • The fluids in which the apparent viscosity increases with increases in velocity gradient ($n > 1$)

the fluid is termed as dilatant (shear-thickening) fluid.

For Dilatant fluids: $n > 1$



50. Match **List-I** (Machining Process) with **List-II** (Application) and select the correct answer using the code give below the lists:

	List-I		List-II
A.	EDM	1.	Holes and cavities in hard and brittle materials
B.	LBM	2.	Micro-drilling and micro-welding of materials
C.	USM	3.	Shaping of hard metals or reshaping of cemented carbide tools
D.	ECM	4.	Shaping of cemented carbide dies and punches

A. A-4, B-1, C-2, D-3

B. A-3, B-2, C-1, D-4

C. A-4, B-2, C-1, D-3

D. A-3, B-1, C-2, D-4

Ans. C

Sol. **EDM** : Shaping of hard metal or alloy steel reshaping of cemented carbide dies, used for moulding, forging, extrusion, wire drawing.

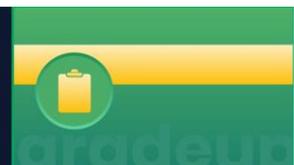
LBM : Micro-drilling and micro welding of material.

USM : Ultrasonic machining is best process for making hole in glass. It can be used for drilling precise hole and ductility in hand and brittle material.

ECM : Shaping of hard metal or reshaping of cemented combine tools.

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Upcoming Mini Mock Challenge in July Month

SSC JE

Mechanical Engineering

Exam	Live Date	Syllabus	No. of Questions	Time
SSC JE Mini Mock Test-1	08 July 2020	Full Syllabus (Tech. (30 Q's) & Non-Tech. (20 Q's))	50	30
SSC JE Mini Mock Test-2	15 July 2020	Full Syllabus (Tech. (30 Q's) & Non-Tech. (20 Q's))	50	30
SSC JE Mini Mock Test-3	22 July 2020	Full Syllabus (Tech. (30 Q's) & Non-Tech. (20 Q's))	50	30
SSC JE Mini Mock Test-4	29 July 2020	Full Syllabus (Tech. (30 Q's) & Non-Tech. (20 Q's))	50	30

