

मध्यप्रदेश लोक सेवा आयोग
रेसीडेन्सी एरिया
इन्दौर

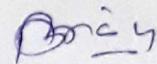
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इन्दौर, दिनांक 16.07.2017

राज्य अभियांत्रिकी सेवा प्रारंभिक परीक्षा -2017 प्रावधिक उत्तर कुंजी

-:: विज्ञप्ति ::-

आयोग के विज्ञापन क्रमांक-03/परीक्षा/2017 दिनांक 08.03.2017 के अंतर्गत आयोजित राज्य अभियांत्रिकी सेवा प्रारंभिक परीक्षा -2017 के प्रथम प्रश्न पत्र- सामान्य अभियोग्यता एवं द्वितीय प्रश्न पत्र के विषय- सिविल इंजीनियरिंग, मेकेनिकल इंजीनियरिंग एवं इलेक्ट्रिकल इंजीनियरिंग की परीक्षा दिनांक-16.07.2017 के वस्तुनिष्ठ प्रकार के प्रश्न पत्रों की प्रावधिक उत्तर कुंजी परीक्षा परिणाम बनाने के पूर्व आयोग की वेबसाइट पर प्रकाशित की जा रही है। अभ्यर्थी आयोग की वेबसाइट पर अपना रोल नंबर एवं प्रवेश पत्र पर दिये गये पासवर्ड की सहायता से लॉग-इन कर अपनी रिस्पांस शीट का अवलोकन कर सकते हैं। यदि इस प्रावधिक उत्तर कुंजी के संबंध में किसी परीक्षार्थियों को कोई आपत्ति हो तो वे ऑनलाईन आपत्तियां 07 दिवस के अन्दर प्रस्तुत कर सकते हैं। इस हेतु अभ्यर्थी प्रश्न क्रमांक, सदर्भ ग्रंथों का नाम एवं दस्तावेज सलग्न करें। प्रावधिक उत्तर कुंजी आयोग की वेबसाइट पर अपलोड होने की तिथि से 07 दिवस की समयावधि के पश्चात प्राप्त आपत्तियों पर विचार नहीं किया जायेगा। यह विज्ञप्ति आयोग की वेबसाइट www.mppsc.com & www.mppsc.nic.in, www.mppscdemo.in पर दिनांक 16.07.2017 से उपलब्ध है।



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State Engineering Services Exam - 2017

(Model Answer Key)

Mechanical Engineering

Q1 : In a simple truss, the total number of members is : (n = total number of joints)

- | | |
|---|------------|
| A | $m = 2n-2$ |
| B | $m = 2n$ |
| C | $m = 2n-3$ |
| D | $m = 2n+3$ |

Answer Key: C

Q2 : According to principle of virtual work, the work done on a rigid body or a system of rigid bodies for any virtual displacements compatible with the constraints of the system in equilibrium is

- | | |
|---|---------------|
| A | Zero |
| B | Maximum |
| C | Minimum |
| D | None of these |

Answer Key: A

Q3 : For fixed support , total number of unknowns are :

- | | |
|---|-------|
| A | Zero |
| B | One |
| C | Two |
| D | Three |

Answer Key: D

Q4 : A solid shaft of diameter 150 mm, length 1200 mm can be subjected to maximum shear stress 80 MPa. A hole of 75 mm diameter is now drilled throughout the length of the shaft. The percentage reduction in torque-carrying capacity of the shaft for the same maximum shear stress is :

- | | |
|---|--------|
| A | 6.25% |
| B | 16.25% |
| C | 26.25% |
| D | 36.25% |

Answer Key: A

Q5 : A 5 m long pin-ended column of square cross section is to be made of steel. Assuming $E = 200$ GPa, $\sigma = 250$ MPa, and using factor of safety $N = 2.5$ in computing Euler's critical load for buckling, determine the size of the cross-section if the column has to support 200 kN load.

| | |
|---------------|--------|
| A | 100 mm |
| B | 400 mm |
| C | 600 mm |
| D | 800 mm |
| Answer Key: A | |

Q6 : In terms of Poisson's ratio (ν), ratio of Young's modulus (E) to shear modulus (G) of elastic materials is

| | |
|---------------|---------------|
| A | $2(1 + \nu)$ |
| B | $2(1 - \nu)$ |
| C | $(1 + \nu)/2$ |
| D | $(1 - \nu)/2$ |
| Answer Key: A | |

Q7 : A compression spring is made of music wire of 2 mm diameter having a shear strength and share modulus of 800 MPa and 80 GPa respectively . The mean coil diameter is 20 mm , free length 40 mm , and the number of active coils is 10. If the mean coil diameter is reduced to 10 mm the stiffness of spring is approximately

| | |
|---------------|----------------------|
| A | decreased by 8 times |
| B | decreased by 2 times |
| C | increased by 2 times |
| D | increased by 8 times |
| Answer Key: D | |

Q8 : A thin walled spherical shell is subjected to an internal pressure. If the radius of shell is increased by 1% and thickness is reduced by 1 % with the internal pressure remaining the same, the % change in circumferential (hoop) stress is

| | |
|---------------|------|
| A | 0 |
| B | 1.01 |
| C | 1.08 |
| D | 2.02 |
| Answer Key: D | |

Q9 : A solid shaft can resist a bending moment of 3 kNm and a twisting moment of 4 kNm together , then the maximum torque that can be applied is :

| | |
|---------------|---------|
| A | 7.0 kNm |
| B | 3.5 kNm |
| C | 4.5 kNm |
| D | 5.0 kNm |
| Answer Key: D | |

Q10 A column has a rectangular cross-section of 10 mm x 20 mm, and length of 1 m . The slenderness ratio of the column is close to

| | |
|----------------------|-----|
| : | |
| A | 173 |
| B | 346 |
| C | 519 |
| D | 692 |
| Answer Key: B | |

| | |
|----------------------|--|
| Q11 | A belt drive is to be designed for transmission of 10.5 kW power from a pulley 800mm in diameter running at 360 rpm . The angle embraced is 165° and coefficient of friction between belt & pulley is 0.3. Safe working stress for leather belt is 2.5 MPa and its density is 1000 kg/m^3 . Thickness of belt is 12 mm . Determine the width of belt taking into account the effect of centrifugal tension in the belt. |
| A | 60 mm |
| B | 131 mm |
| C | 262 mm |
| D | 393 mm |
| Answer Key: B | |

| | |
|----------------------|--|
| Q12 | A shaft rotating at $N=420 \text{ rpm}$ is supported by a thrust bearing having external and internal diameter $d_o = 400 \text{ mm}$ & $d_i = 240 \text{ mm}$, respectively. Axial load on the bearing is $W=150 \text{ kN}$ while the intensity of pressure is limited to $p=325 \text{ kN/m}^2$. Determine the power lost in overcoming the friction if the coefficient of friction is $\mu = 0.05$. |
| A | 53.87 kW |
| B | 35.78 kW |
| C | 200.12 kW |
| D | 135.41 kW |
| Answer Key: A | |

| | |
|----------------------|---|
| Q13 | 20° full depth involute profiled 19-tooth pinion and 37-tooth gear are in mesh. If the module is 5 mm, the centre distance between the gear pair will be : |
| A | 280 mm |
| B | 140 mm |
| C | 150 mm |
| D | 300 mm |
| Answer Key: B | |

| | |
|------------|--|
| Q14 | A disc clutch is required to transmit 5 kW at 2000 rpm. The disc has a friction lining with coefficient of friction equal to 0.25. Bore radius of friction lining is 25mm. Assuming uniform contact pressure of 1 MPa , find the value of outside radius of friction lining. |
| A | 39.41 mm |
| B | 19.71 mm |
| C | 78.82 mm |
| | |

D 59.12 mm

Answer Key: A

Q15 Tooth interference in an external involute spur gear pair can be reduced by :

A decreasing centre distance between gear pair

B decreasing the module

C decreasing the pressure angle

D increasing the number of gear teeth

Answer Key: D

Q16 Circular disc of uniform thickness 20 mm, radius 200 mm and mass 20 kg is used as fly wheel. If it rotates at 600 rpm the Kinetic energy of fly wheel (in Joules) is approximately:

A 395

B 790

C 1580

D 3950

Answer Key: B

Q17 Balancing of a rigid rotor can be achieved by appropriately balancing masses in :

A A single plane

B Two planes

C Three planes

D Four planes

Answer Key: B

Q18 Velocity ratio between pinion and gear in a gear drive is 2.3, module of teeth is 2.0 mm and sum of number of teeth on pinion and gear is 99. What is the centre distance between pinion & gear ?

A 49.5 mm

B 99 mm

C 148.5 mm

D 198 mm

Answer Key: B

Q19 In a flat belt drive, if the slip between driver and belt is 1%, and between belt and follower is 3%. The driver & follower pulley diameters are equal, the velocity ratio of the drive will be

A 0.99

B 0.98

C 0.97

| | |
|---|------|
| C | |
| D | 0.96 |

Answer Key: **D**

Q20 In the multiple disc clutch, if there are 6 discs on the driving shaft and 5 discs on the driven shaft, then number of pairs of contact surfaces will be equal to

| | |
|---|----|
| A | 11 |
| B | 12 |
| C | 10 |
| D | 22 |

Answer Key: **C**

Q21 A cantilever beam of span L supporting a uniformly distributed load ω on entire span of the beam. The maximum value of bending moment will be .

| | |
|---|------------------|
| A | ωL^2 |
| B | $1/2 \omega L^2$ |
| C | ωL^3 |
| D | $1/2 \omega L^3$ |

Answer Key: **B**

Q22 The life of a ball bearing at a load of 15 kN is 10,000 hours. Determine the life (in hours), if the load is increased to 20 kN for the same operating condition.

| | |
|---|--------------|
| A | 10,000 hours |
| B | 8,000 hours |
| C | 4,218 hours |
| D | 2,109 hours |

Answer Key: **C**

Q23 A 26-teeth, 5 mm module, 20° full depth pinion receives 5.1 kW at 750 rpm. Determine the tangential force on the gear.

| | |
|---|-----|
| A | 1kN |
| B | 2kN |
| C | 3kN |
| D | 4kN |

Answer Key: **A**

Q24 Two mating spur gears have 40 and 120 teeth (pinion) respectively. The pinion rotates at 1200 rpm and transmits a torque of 20 Nm. The torque transmitted by the gear is

| | |
|---|--------|
| A | 6.6 Nm |
| | 20 Nm |

| | |
|----------------------|-------|
| B | |
| C | 40 Nm |
| D | 60 Nm |
| Answer Key: D | |

Q25 A 60 mm long and 6mm thick fillet weld carries a steady load of 15 kN along the weld. The shear strength of the weld material is 200 MPa. The factor of safety is :

| | |
|----------------------|------|
| A | 1.13 |
| B | 2.26 |
| C | 3.39 |
| D | 4.52 |
| Answer Key: C | |

Q26 A ball bearing operating at a load **F** has 8000 hours of life. The life of bearing, in hours, when load is doubled to **2F** is :

| | |
|----------------------|------|
| A | 8000 |
| B | 6000 |
| C | 4000 |
| D | 1000 |
| Answer Key: D | |

Q27 A band brake having band-width of 80 mm, drum dia. of 250mm, coefficient of friction 0.25 and angle of wrap of 270° is required to exert a friction torque of 1000Nm. The maximum tension (kN) developed in the band is approximately :

| | |
|----------------------|-------|
| A | 1.88 |
| B | 3.56 |
| C | 6.12 |
| D | 11.56 |
| Answer Key: D | |

Q28 A solid circular shaft needs to be designed to transmit a torque of 50Nm. If the allowable shear stress of the material is 140 MPa, assuming a factor of safety of 2, the minimum allowable design diameter(mm) is

| | |
|----------------------|----|
| A | 8 |
| B | 16 |
| C | 24 |
| D | 32 |
| Answer Key: B | |

Q29 Eight bolts are to be selected for fixing the cover plate of a cylinder subjected to a maximum load of 980 kN. If the design stress for the bolt material is 315N/mm^2 , what is the diameter of each bolt ?(consider the closest option)

| | |
|---|-------|
| A | 11 mm |
|---|-------|

| | |
|----------------------|---------|
| B | 22.2 mm |
| C | 33 mm |
| D | 44.4 mm |
| Answer Key: B | |

Q30 In the assembly design of shaft, pulley and key, the weakest member is :

| | |
|----------------------|---------------|
| A | Pulley |
| B | Key |
| C | Shaft |
| D | None of these |
| Answer Key: B | |

Q31 In an orthogonal cutting, rake angle of the tool is 25° and friction angle is 27° . Using Merchant's shear angle relationship, calculate the value of shear angle.

| | |
|----------------------|------------|
| A | 44° |
| B | 33° |
| C | 22° |
| D | 11° |
| Answer Key: A | |

Q32 Through holes of 12mm diameter are to be drilled in a steel plate of 25mm thickness. Drill spindle speed is 240 rpm, feed is 0.25mm/rev and drill point angle is 120° . Assuming over travel of drill as 3mm, find the approximate time required for machining of the hole.

| | |
|----------------------|---------------|
| A | 10.45 seconds |
| B | 15.73 seconds |
| C | 31.46 seconds |
| D | 26.18 seconds |
| Answer Key: C | |

Q33 The rake angle of cutting tool is 10° , shear angle 35° and cutting velocity 25m/min. Calculate the chip velocity along the face (m/min)

| | |
|----------------------|-------|
| A | 7.91 |
| B | 15.82 |
| C | 45.82 |
| D | 31.64 |
| Answer Key: B | |

Q34 Orthogonal cutting of mild steel has the given data: cutting speed = 35m/min, depth of cut = 0.25mm, tool rake angle = 10°, chip thickness = 0.8mm, cutting force = 925N, thrust force = 475 N. Using Merchant analysis, find the friction angle(approximately).

A 10°

B 27°

C 37°

D 48°

Answer Key: C

Q35 A batch of 10 cutting tools could produce 500 components while working at 50 rpm with a tool feed of 0.25 mm/rev. and depth of cut =1mm. A similar batch of 10 tools of the same specifications could produce 122 components while working at 80 rpm with a feed of 0.25 mm/rev and 1mm depth of cut. How many components can be produced with one cutting tool at 60 rpm? (consider closest option).

A 29

B 31

C 37

D 42

Answer Key: A

Q36 Internal gear cutting operation can be performed by

:

A Milling

B Shaping with rack cutter

C Shaping with pinion cutter

D Hobbing

Answer Key: C

Q37 A steel bar 200mm in diameter is turned at a feed of 0.25 mm/rev. with a depth of cut of 4mm. The rotational speed of work piece is 160 rpm. The material removal rate (mm³/s)is

A 160

B 167.6

C 1600

D 1675.5

Answer Key: D

Q38 It is required to cut screw threads of 2mm pitch on a lathe. Lead screw has pitch of 6mm. If spindle speed is 60 rpm, find the speed(rpm)of lead screw for single start threads.

A 10

B 20

C 100

D 200

D

Answer Key: B

Q39 In metal cutting operation, the approximate ratio of heat distributed among chip, tool and work, in that order is :

| | |
|---|----------|
| A | 70:20:10 |
| B | 33:33:33 |
| C | 20:70:10 |
| D | 10:10:80 |

Answer Key: A

Q40 A metric thread of pitch = 2mm and thread angle = 60° is inspected for its pitch diameter using 3- wire method. The diameter(mm) of the best size wire is :

| | |
|---|-------|
| A | 0.866 |
| B | 1.000 |
| C | 1.154 |
| D | 2.000 |

Answer Key: C

Q41 Manufacturing of a product requires fixed investment of Rs 1,20,000 in a particular year. The estimated sales for this period is 4,00,000 units. The variable cost per unit product is Rs 6. Determine the break even point of production if unit price of product is Rs 30.

| | |
|---|-------|
| A | 2000 |
| B | 3000 |
| C | 5000 |
| D | 10000 |

Answer Key: C

Q42 The sale of cycles in a shop in four consecutive months are 70,68,82 & 95. Exponentially smoothing average method with a smoothing factor of 0.4 is used in forecasting. The expected number of sales of cycles in the next (i.e. 5th) month is :

| | |
|---|-------|
| A | 73.52 |
| B | 37.25 |
| C | 36.76 |
| D | 18.38 |

Answer Key: A

Q43 When 3-2-1 principal is used to support and locate a three dimensional workpiece during machining, the number of degree of freedom that are restricted is :

| | |
|---|---|
| A | 7 |
| B | 8 |

| | |
|---------------|----|
| C | 9 |
| D | 10 |
| Answer Key: C | |

Q44 In MRP system, component demand is :

| | |
|---------------|---|
| A | Forecasted |
| B | Established by the master production schedule |
| C | Calculated by the MRP system for the master production schedule |
| D | Ignored |
| Answer Key: C | |

Q45 The maximum level of inventory of an item is 100 and it is achieved with infinite replenishment rate. The inventory becomes zero over one and half month due to consumption at a uniform rate. This cycle continues throughout the year. Ordering cost is Rs. 100 per order and inventory carrying cost is Rs. 10 per item per month. Annual cost (Rs.) of the plan, neglecting the material cost is

| | |
|---------------|------|
| A | 1200 |
| B | 2400 |
| C | 4800 |
| D | 6800 |
| Answer Key: C | |

Q46 In a single server infinite population queuing model. Arrivals follow a Poisson distribution with mean $\lambda = 6$ per hour. The service times are exponential with mean service time equal to 6 minutes. Determine the expected length of queue.

| | |
|---------------|-----|
| A | 0.3 |
| B | 0.6 |
| C | 0.9 |
| D | 1.2 |
| Answer Key: C | |

Q47 In PERT analysis, a critical activity has :

| | |
|---------------|---------------|
| A | Maximum float |
| B | Zero float |
| C | Maximum cost |
| D | Minimum cost |
| Answer Key: B | |

Q48 A project has six activities (A to F) with respective activity durations 7,5,6,6,8,4 days. The network has three paths A-B, C-D, and E-F. All the activities can be crashed with the same crash cost per day. The number of activities that need to be crashed to reduce the project duration by one day is

| | |
|---|---|
| A | 1 |
| B | 2 |
| C | 3 |
| D | 6 |

Answer Key: C

Q49 Six jobs arrived in a sequence as given below:-

| Job | Processing time (days) |
|-----|------------------------|
| I | 4 |
| II | 9 |
| III | 5 |
| IV | 10 |
| V | 6 |
| VI | 8 |

Average flow time (in days) for the given jobs using shortest processing time (SPT) rule is

| | |
|---|--------|
| A | 20.83 |
| B | 23.16 |
| C | 125.00 |
| D | 139.00 |

Answer Key: A

Q50 If there are n jobs to be performed, one at a time, on each of m machines, the possible sequences would be

| | |
|---|----------|
| A | $(n!)^m$ |
| B | $(m!)^n$ |
| C | n^m |
| D | m^n |

Answer Key: A

Q51 A heat pump is used to heat a house in winter and then reversed to cool in the summer. The inside temperature of the house is to be maintained at 20°C . The heat transfer through the house walls is 7.9 kJ/s and the outside temperature in winter is 5°C . Calculate the approximate minimum power required to drive the heat pump.

| | |
|---|----------|
| A | 101.11 W |
| B | 202.22 W |
| C | 303.33 W |
| D | 404.44 W |

Answer Key: D

Q52 Engine operates between hot thermal reservoir and cold thermal reservoir. Engine A operates between 1500°K and 300°K , develops 30 kW for 300 kW heat supplied. Engine B operates between 750°K and 300°K , develops 20 kW for 200 kW heat supplied. Which statement is right for second law efficiency (η_{II}) of engines

| | |
|----------------------|-----------------------------|
| A | $\eta_{II,A} > \eta_{II,B}$ |
| B | $\eta_{II,A} < \eta_{II,B}$ |
| C | $\eta_{II,A} = \eta_{II,B}$ |
| D | None of these |
| Answer Key: B | |

Q53 A steel billet of 2000 kg mass is to be cooled from 1250°K to 450°K. The heat released during this process is to be used as a source of energy. The ambient temperature is 303°K and specific heat of steel is 0.5 kJ/kg K. The available energy of the billet is about

| | |
|----------------------|-----------|
| A | 490.44 MJ |
| B | 30.95 MJ |
| C | 10.35 MJ |
| D | 800.12 MJ |
| Answer Key: A | |

Q54 If a closed system is undergoing an irreversible process, the entropy of the system

| | |
|----------------------|--------------------------|
| A | Must increase |
| B | Always remains constant |
| C | Must decrease |
| D | May increase or decrease |
| Answer Key: D | |

Q55 Heat and work are

| | |
|----------------------|----------------------|
| A | Intensive properties |
| B | Extensive properties |
| C | Point functions |
| D | Path functions |
| Answer Key: D | |

Q56 A heat reservoir at 900°K is brought into contact with the ambient at 300°K for a short time. During this period, 9000 kJ of heat is lost by the heat reservoir. The total loss in availability due to this process is.

| | |
|----------------------|---------------|
| A | 18000 kJ |
| B | 9000 kJ |
| C | 6000 kJ |
| D | None of these |
| Answer Key: B | |

Q57 A single acting two-stage compressor with complete inter cooling delivers air at 16 bar. Assuming an intake stage of 1 bar at 15°
: C, the pressure ratio per stage is

A 16

B 8

C 4

D 2

Answer Key: C

Q58 In a gas turbine cycle, the turbine output is 600 kJ/kg, the compressor work is 400 kJ/kg and the heat supplied is 1000 kJ/kg. The
: thermal efficiency of cycle is

A 80%

B 60%

C 40%

D 20%

Answer Key: D

Q59 A gas turbine works on which one of the following cycles?
:

A Brayton

B Rankine

C Stirling

D Otto

Answer Key: A

Q60 Three moles of an ideal gas are compressed to half the initial volume at a constant temperature of 300°K. The work done in the
: process is about

A 5186 J

B 2500 J

C -2500 J

D -5186 J

Answer Key: D

Q61 A circular annular plate having outer and inner diameter of 2.5 m and 1.25 m respectively, is immersed in water with its plane
: making an angle of 45° with the horizontal. The center of circular annular plate is 2.0 m below the free surface. What is the hydrostatic thrust on one side of the plate?

A 72.2 kN

B 36.1 kN

C 18.1 kN

D 144.4 kN

Answer Key: A

Q62 A pitot tube is used to measure the velocity of air having density 1.2 kg/m^3 . At a point, the difference in the stagnation and static pressures of a pitot(static) tube is found to be 450 Pa. Determine the velocity of air at the point in m/s.

- A 27.38 m/s
- B 18.69 m/s
- C 9.34 m/s
- D 54.76 m/s

Answer Key: A

Q63 A pipe of 18 cm diameter and 15 km length is used to transport oil of viscosity $\mu = 0.1 \text{ Nm/s}^2$ from a tanker to the shore with a velocity of 0.5 m/s. The flow is laminar. Determine the power required to maintain the flow.

- A 18.84 kW
- B 9.42 kW
- C 81.84 kW
- D 4.76 kW

Answer Key: B

Q64 A fluid flow is represented by the velocity field $\vec{v} = ax\hat{i} + ay\hat{j}$, where a is constant. The equation of streamline passing through a point (1,2) is

- A $x - 2y = 0$
- B $2x + y = 0$
- C $2x - y = 0$
- D $x + 2y = 0$

Answer Key: C

Q65 For the stability of a floating body, under the influence of gravity alone, which of the following is true?

- A Metacentre should be below center of gravity
- B Metacentre should be above center of gravity
- C Metacentre and center of gravity must lie on same horizontal line.
- D Metacentre and center of gravity must lie on the same vertical line.

Answer Key: B

Q66 A U-tube open on both ends and made of 8 mm diameter glass tube has mercury up to a height of 10 cm in both the limbs. If 19 cm^3 of water is added to one of the limbs, what is the approximate difference in mercury level in the two limbs at equilibrium?

- A 4.5 mm
- B 1.0 mm
- C 2.8 mm

D 3.2 mm

Answer Key: C

Q67 An aeroplane is cruising at a speed of 750 kmph at an altitude, where the air temperature is 5°C. Calculate the flight Mach number at this speed.

A 0.31

B 0.62

C 0.93

D None of these

Answer Key: B

Q68 An impulse turbine has nozzle efficiency 0.85, blade velocity ratio 0.6 and mean blade velocity 225 m/s. calculate the isentropic heat (in kJ/kg) drop in the nozzle.

A 41.36 kJ/kg

B 82.72 kJ/kg

C 20.68 kJ/Kg

D 62.04 kJ/kg

Answer Key: B

Q69 In order to have maximum power from a Pelton turbine, the bucket speed must be :

A Equal to the jet speed

B Equal to half of jet speed

C Equal to twice of jet speed

D Equal to three time of jet speed

Answer Key: B

Q70 A moist air is maintained at 1 bar such that its dry bulb temperature is 20°C and dew point temperature is 5°C. The values of saturation pressure of steam at 20°C & 5°C are 0.02339 bar and 0.00872 bar, respectively. Calculate the relative humidity of the moist air.

A 37.28%

B 36.7%

C 18.2%

D None of these

Answer Key: A

Q71 A furnace is made of a red brick wall of thickness 250cm and conductivity 1.2 W/mK. Determine the thickness of a layer of diatomic earth of conductivity 0.15 W/mK that can be used to replace the brick wall for the same heat loss and temperature drop.

A 3.12 cm

B 6.24 cm

| | |
|---------------|----------|
| C | 9.36 cm |
| D | 12.48 cm |
| Answer Key: A | |

Q72 A wire of 18mm diameter is exposed to air where convective heat transfer coefficient is $h = 25 \text{ W/m}^2\text{K}$. The wire is to be laid with an insulating layer of thermal conductivity 0.6 W/mK . Determine the thickness of the insulation for the maximum heat dissipation

| | |
|---------------|-------|
| A | 5 mm |
| B | 10 mm |
| C | 15 mm |
| D | 20 mm |
| Answer Key: C | |

Q73 Determine the heat transfer coefficient from a 120 mm diameter steel pipe placed horizontally in ambient at 25°C . Nusselt number is 30 and thermal conductivity of air is 0.05 W/mK .

| | |
|---------------|------------------------------|
| A | $12.5 \text{ W/m}^2\text{K}$ |
| B | $5.0 \text{ W/m}^2\text{K}$ |
| C | $15.2 \text{ W/m}^2\text{K}$ |
| D | $20.0 \text{ W/m}^2\text{K}$ |
| Answer Key: A | |

Q74 Determine the net radiation per square meter between two very large plates at temperature. 327°C & 127°C . The emissivity of the hot and cold plates are 0.75 and 0.65 respectively. Stefan Boltzmann constant is $5.67 \times 10^{-8} \text{ W/m}^2\text{K}$

| | |
|---------------|------------------------|
| A | 3.15 kW/m^2 |
| B | 6.30 kW/m^2 |
| C | 4.75 kW/m^2 |
| D | 12.60 kW/m^2 |
| Answer Key: A | |

Q75 A counter flow shell and tube heat exchanger is used to heat water with hot exhaust gases. The water ($C_p = 4180 \text{ J/kgC}$) flows at a rate of 2 kg/s while the exhaust gas ($C_p = 1030 \text{ J/kgC}$) flows at the rate of 5.25 kg/s . If the heat transfer surface area is 32.5 m^2 and the overall heat transfer coefficient is $200 \text{ W/m}^2\text{C}$, what is the NTU for the heat exchanges?

| | |
|---------------|-----|
| A | 1.2 |
| B | 2.4 |
| C | 3.6 |
| D | 4.8 |
| Answer Key: A | |

Q76 A fin has 5 mm diameter and 100 mm length. The thermal conductivity of fin material is 400 W/mK. One end of the fin is maintained at 130°C and its remaining surface is exposed to ambient air at 30°C. If the convective heat transfer coefficient is 40 W/m²K, the heat loss (W) from the fin is:

A 0.08

B 5.02

C 7.02

D 7.82

Answer Key: C

Q77 In an condenser of a power plant, the steam condenses at a temp of 60°C. The cooling water enters at 30°C and leaves at 45°C. LMTD of the condenser is

A 16.2°C

B 21.6°C

C 30°C

D 37.5°C

Answer Key: B

Q78 A moist air sample has dry bulb temperature of 30°C and specific humidity of 11.5 g water vapour per kg dry air. Assume molecular weight of air as 28.93. If the saturation vapor pressure of water at 30°C is 4.24 kPa and total pressure is 90kPa, then the relative humidity (%) of air sample is

A 50.5

B 38.5

C 56.5

D 68.5

Answer Key: B

Q79 If a mass of moist air in airtight vessel is heated to a higher temperature, then:

A Specific humidity of air increases

B Specific humidity of air decreases

C Relative humidity of air increases

D Relative humidity of air decreases

Answer Key: D

Q80 In summer air conditioning, the condition of air passing through the space undergoes a process of:

A Sensible cooling

B Sensible heating

C Cooling and dehumidification

D Heating and humidification

Answer Key: C

Q81 In a boiler, feed water supplied per hour is 215 kg, while coal fired per hour is 25 kg. Net enthalpy rise per kg of water is 150 kJ. If the calorific value of coal is 2000 kJ/kg, determine the boiler efficiency.

A 25%

B 50%

C 64.5%

D 100%

Answer Key: C

Q82 A spark ignition engine operates at compression ratio 7.5 to produce $(24 \times 10^5 \times v_c)$ J work per cycle, where v_c is clearance volume (in m^3). Determine the indicated mean effective pressure in the cylinder.

A 1.23 bar

B 2.46 bar

C 3.69 bar

D 4.92 bar

Answer Key: C

Q83 In an Otto cycle, air is compressed adiabatically from 27°C and 1 bar to 16 bar. Heat is supplied at constant volume until the pressure rises to 40 bar. For the air, $\gamma=1.4$, $C_v=0.718$ kJ/kg K and $R = 0.2872$ kJ/kg K. The mean effective pressure of the cycle is:

A 2.63 bar

B 5.26 bar

C 7.89 bar

D None of these

Answer Key: B

Q84 A single cylinder C.I. engine has 35% brake thermal efficiency and 75% mechanical efficiency. It is supplied with high speed diesel oil of 40 MJ/kg calorific value. The brake specific fuel consumption (BSFC) and Indicated specific fuel consumption (IFSC) respectively is :

A 0.257 kg/h-kW, 0.193 kg/h-kW

B 0.128 kg/h-kW, 0.193 kg/h-kW

C 0.257 kg/h-kW, 0.097 kg/h-kW

D None of these

Answer Key: A

Q85 In air-standard Otto cycle, the compression ratio is 10. The condition at the beginning of the compression is 100 kPa and 27°C . Heat added at constant volume is 1500 kJ/kg, while 700 kJ/kg of heat is rejected during the other constant volume process in the cycle. Specific gas constant for air = 0.287 kJ/kg K. The mean effective pressure (kPa) of the cycle is

A 103.23 kPa

| | |
|----------------------|---------------|
| B | 1032.3 kPa |
| C | 2064.6 kPa |
| D | none of these |
| Answer Key: B | |

Q86 A hydraulic turbine develops 1000 kW power for a head of 40 m. If the head is reduced to 20m, the power developed (kW) is :

| | |
|----------------------|--------|
| A | 177.33 |
| B | 353.55 |
| C | 505.44 |
| D | 707.77 |
| Answer Key: B | |

Q87 In case of a Diesel cycle , increasing the cut-off ratio will increase :

| | |
|----------------------|-------------------------|
| A | Efficiency |
| B | Mean effective pressure |
| C | Maximum weight |
| D | The engine weight |
| Answer Key: B | |

Q88 The bore and stroke of the cylinder of a 6-cylinder engine working on an Otto-cycle are 17 cm and 30 cm, respectively .Total clearance volume is 9225 cm³, then what is the compression ratio ?

| | |
|----------------------|------|
| A | 7.8 |
| B | 6.2 |
| C | 15.8 |
| D | 5.4 |
| Answer Key: D | |

Q89 The air-fuel ratio for idling speed of an automobile petrol engine is closer to :

| | |
|----------------------|------|
| A | 10:1 |
| B | 15:1 |
| C | 17:1 |
| D | 21:1 |
| Answer Key: A | |

Q90 In the operation of four-stroke Diesel engine , the term 'Squish ' refers to :

| | |
|---------------|--|
| A | injection of fuel in pre-combustion chamber |
| B | discharge of gases from the combustion chamber |
| C | entry of air into the combustion chamber |
| D | Stripping of fuel from the core. |
| Answer Key: C | |

Q91 Stepper motor of a point-to-point controlled NC machine has specification sensitivity of 3° /pulse . Pitch of lead screw is 2.4 mm. Determine the expected positioning accuracy

| | |
|---------------|------------|
| A | 10 μ m |
| B | 20 μ m |
| C | 30 μ m |
| D | 40 μ m |
| Answer Key: B | |

Q92 A multiple automatic centre performs four operations with times 100, 120, 135 and 155 seconds at each of its work centers. Determine the cycle time (time required to manufacture one work piece) of the work centre.

| | |
|---------------|---------|
| A | 100 sec |
| B | 120 sec |
| C | 135 sec |
| D | 155 sec |
| Answer Key: D | |

Q93 NC contouring is an example of

| | |
|---------------|-------------------------------|
| A | Continuous path positioning |
| B | Point -to - point positioning |
| C | Absolute positioning |
| D | Incremental positioning |
| Answer Key: A | |

Q94 Which type of motor is not used in spindle drives of CNC machine tools?

| | |
|---------------|--------------------|
| A | Induction motor |
| B | Stepper motor |
| C | DC servo motor |
| D | Linear servo motor |
| Answer Key: A | |

Q95 A CNC vertical milling machine has to cut a straight slot of 10 mm width and 2 mm depth by a cutter of 10 mm diameter

: between points (0,0) and (100, 100) on the XY plane (dimensions in mm) .The feed rate used for milling is 50 mm /min. Milling time for the slot is

- A 121.1 sec
- B 170 sec
- C 181.7 sec
- D 240 sec

Answer Key: C

Q96 A CNC program block, N002 G02 G91 X40 Z40 ----- G02 and G91 refer to :

- A Circular interpolation in counter clock wise direction and incremental dimension
- B Circular interpolation in counter clock wise direction and absolute dimension
- C Circular interpolation in clock wise direction and incremental dimension
- D Circular interpolation in clock wise direction and absolute dimension

Answer Key: C

Q97 In a CAD package mirror image of a 2D point P(5,10) is to be obtained about a line which passes through the origin and makes an angle of 45° counter clock-wise with X-axis. The coordinates of the transformed point will be

- A 7.5,5
- B 10,5
- C 7.5,-5
- D 10,-5

Answer Key: B

Q98 Current major commercial CAD/CAM systems include :

- A Uni graphics
- B Pro/E
- C IDEAS
- D All of these

Answer Key: D

Q99 In a CNC machine tool , encoder is used to sense and control :

- A Table position
- B Table velocity
- C Spindle speed
- D Coolant flow

Answer Key: A

Q100 The work table of a positioning system is driven by a lead screw having pitch = 8 mm. Lead screw is connected to the output shaft of a stepper motor through gear box whose ratio is 6 :1. The stepper motor has 48 step angles. Determine the no. of pulses and speed of stepper motor required to move the table a distance of 200 mm from its present position at a linear velocity of 440 mm/min.

| | |
|---|-----------------|
| A | 7920, 330 rpm |
| B | 792, 33.0 rpm |
| C | 79.2, 33.0 rpm |
| D | 79200, 3300 rpm |

Answer Key: A

