MPSC 2019
Maharashtra Public Service Commission
Preliminary Examination
Combined for Group A and B
Civil Engineering
Date of Exam: 23/06/2019

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Q.1 वाक्यात नातु असणे या वाक्यचाराचा अर्थ सांगा
(a) श्रीमंत माणूस (b) वशिल्याचा माणूस
(c) मिजासखां माणूस (d) अति लांबचा किवा दूरचा माणूस
Ans. (c)

Q.2 कृपया वाक्याची योग्यता निर्धारित करा?
(a) उपसर्गार्थी (b) शब्दसाधित
(c) अन्यत्र (d) सामालिक
Ans. (b)

Q.3 समानांतर शब्दाच्या जोडव्या लावा:
'अ' 'ब'
a. पूल i. एकाख
b. काकवा ii. अंड़जून
c. झोक iii. सुम
d. प्रशी iv. चक्कु
पर्यायी उत्तरे:
अ ब क ड
(a) iv i ii iii
(b) ii iii i iv
(c) iii i iv ii
(d) i ii iii iv
Ans. (c)

Q.4 वशिला असलेली माणसं मोठया पदावर सहज जातात, या वाक्यातील उद्देश्यविश्वासारे ओळखा.
a. माणसं मोठया पदावर
d. वशिला असलेली
(c) वशिला
d. वशिला असलेली
(a) फक्त ड बरोबर (b) फक्त ब बरोबर
(c) ब आणि ड बरोबर (d) फक्त क बरोबर
Ans. (a)
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Q.5 कोल्हा काकडीता राजी या मृणीचे समाप्त स्पष्टीकरण कोणते?
(a) जे निळाटे वपडवणूक समाधान असेल, वाईट गोष्टी ही वेवटपर्यंत वाईट वसते, वर्धणी मागण्येचे गावाचे माहिती पाहणारे.
(b) जे धुत वसते श्रेणी नाही, गावाचे माहिती वेवटी असलेली होणाऱ्याची पाहणारे.
(c) जे धुत मागण्येचे श्रेणी होणाऱ्याचे माहिती पाहणारे.
(d) जे निळाटे वपडवणूक समाधान असेल, गावाचे माहिती पाहणारे.

Ans. (c)
Q.6 राहकारी चब्बीढ़ीत श्रमांतरा विकास करण्यासाठी कशाकडे लक्ष दिले पाहिजे?
(a) उपनिव (b) सामाध्य (c) घोटाळे (d) राजकारण
Ans. (a)

Q.7 राहकारी चब्बीढीत कोणत्या जाणिवांची उणीव आहे?
(a) राजकीय व नक्काश (b) नैतिक व आध्यात्मिक (c) साहित्य व सांस्कृतिक (d) विकास व सुधारणावाची
Ans. (b)

Q.8 राहकारी संस्था सांगध्यानाची होण्यासाठी कशाची गरज आहे?
(a) प्रशिक्षित मनुष्यवंश (b) आधुनिक तंत्रज्ञान (c) सैद्धांतिक नाशणी (d) व्यवहारिक उपाययोजना
Ans. (a)

Q.9 या उतान्ताला योग्य शीर्षक या
(a) सहकार (b) सामाध्य आणि सहकार (c) सहकार महर्षी (d) सहकारी चब्बीढीची पुनर्स्थापना
Ans. (d)

Q.10 सेवा आणि उद्दीप्त या क्षेत्रात कशाचा दूर्मान सन्दर्भान होत आहे?
(a) आचार्यकारण (b) मांडवलाशी (c) जागतिकीकारण (d) मुख्य अर्थव्यवस्था
Ans. (c)

Q.11 You could forgive all his asperities when he smiled.
Identify the correct meaning of the word underlined.
(a) cruelty (b) malignity (c) malice (d) roughness
Ans. (d)
Q.12 Choose the correct word which is the most opposite to the meaning of the underlined word in the sentence.
At night much of the activity comes to rest.
(a) cessation (b) tranquility
(c) pause (d) exertion
Ans. (d)

Q.13 Match the synonyms:
A. agile I. royal
B. human II. permanent
C. majestic III. active
D. perennial IV. gentle

A B C D
(a) I II III
(b) III I IV I
(c) III IV I I
(d) IV III I I
Ans. (c)

Q.14 All his efforts proved to be a mare’s nest in the long run.
Identify the correct meaning of the underlined.
(a) irrelevant (b) unimportant
(c) worthless (d) insincere
Ans. (c)

Q.15 He is a man of the world. His honest advice will help us a lot.
Identify the correct meaning of the underlined.
(a) an important person (b) an experienced person
(c) a social person (d) a genius
Ans. (b)

Directions (Q. 16 to 20): Read the following passage carefully and choose the most correct option given below each question.
The third great defect of our civilization is that is does not know what to do with its knowledge. Science has given us powers fit for the gods, yet we use them like small children. For example, we do not know how to manage our machines. Machines were made to be man’s servants; yet he has grown so dependent on them that they are in a fair way to become his masters. Already most men spend most of their lives looking after and waiting upon machines. And the machine are very storm masters. They must be fed with coal, and given petrol to drink, and oil to wash with and they must be kept at the right temperature. And if they do not get their meals when they expect them, they grow sulky and refuse to work, or burst with rage, and blow up, and
spread ruin and destruction all around them. So we have to wait upon them very attentively and
do all that we can to keep them in a good tamper. Already we find it difficult either to work
or play without the machines, and a time may come when they will rule us altogether, just as
we rule the animals.

And this brings me to the point at which I asked, “What do we do with all the time which the
machines have saved for us, and the new energy they have given us?” On the whole, it must
be admitted, we do very little. For the most part we use our time and energy to make more
and better machines; but more and better machines will only give us still more time and still
more energy, and what are we to do with them? The answer, I think, is that we should try to
become more civilized. For the machines themselves, and the power which the machines have
given us, are not civilization but aids meant making and linking beautiful things, thinking freely,
and living rightly and maintaining justice equally between man and man. Man has a better chance
today to do these things than he ever has before; he has more time, more energy, less to fear
and less to fight against. If he will give his time and energy which his machines have won for
him to making more beautiful things, to finding out more and more about the universe, to removing
the causes of quarrels between nations, to discovering how to prevent poverty, then I think our
civilization would undoubtedly be the greater, as it would be the most lasting that there has ever
been.

Q.16 The machines themselves and the powers they have given to us ______.
1. are nothing but civilization.
2. are only the aids to civilization.
3. are only to multiply the production.
4. are ways to make the people wealthy.

Answer options:
(a) 1 and 3 are correct
(b) 1 and 4 are correct
(c) 2 is correct
(d) 3 is correct

Ans. (c)

Q.17 The passage is about
1. civilization.
2. only the defects of civilization.
3. making the things more beautiful using the power given by machines.
4. removing the causes of quarrels between the nations and overcoming poverty.

Answer options:
(a) Only 1 is correct
(b) Only 2 is correct
(c) 1, 3 and 4 are correct
(d) 2, 3 and 1 are correct

Ans. (c)
Q.18  We use, according to the writer, the powers that are given by science unlike ______.
1.  God  2.  Small children

**Answer options:**
(a)  Only 2 is correct  (b)  Only 3 is correct
(c)  1 and 2 are correct  (d)  3 and 4 are correct

**Ans.**  (*)
First paragraph second line states like small children.....
Question is asking about unlike.
So we use powers unlike god or unlike masters will be the answer.

Q.19  If the machines do not get their meal in time, they will _______.
1.  grow sulky and refuse to work.  2.  obey their masters.
3.  burst with rage and blow up.  4.  not cause ruin and destruction.

**Answer options:**
(a)  1 and 2 are correct  (b)  2 and 3 are correct
(c)  3 and 4 are correct  (d)  1 and 3 are correct

**Ans.**  (d)

Q.20  We all agree that being civilized means _______.
1.  earning more and more money.
2.  making and linking beautiful things.
3.  grabbing property of others.
4.  maintaining justice equally between men and women.

**Answer options:**
(a)  2 and 4 are correct  (b)  1 and 2 are correct
(c)  3 and 4 are correct  (d)  4 and 1 are correct

**Ans.**  (a)

Q.21  Consider the following statements:
1.  The average CPI inflation declined to 4.9% in 2015 - 16 from 5.9% in 2014 - 15.
2.  The average inflation based on the Whole-sale Price Index declined to (–) 2.5% in 2015 - 16 from 2.0% in 2014 - 15.
3.  The average inflation was 2.9% during April - December 2016.
Which of the statement/s given above is/are correct?
(a)  1 and 2  (b)  2 and 3
(c)  1 and 3  (d)  All of the above
Q.22 Consider the following statements:
1. Indian planning is indicative economic planning.
2. Indian planning is physical planning.
3. Indian planning is social planning.
Which of the statements given above are correct?
(a) 1 and 2  
(b) 2 and 3  
(c) 1 and 3  
(d) All of the above

Ans.  (d)

Q.23 The tax imposed on import and export of commodities is called as______.
(a) Custom duties  
(b) Excise duties  
(c) VAT  
(d) GST

Ans.  (a)

Q.24 During the last few years _____ used the open market sale of rice and wheat to check market price of these essential food-grains.
(a) FCI  
(b) NABARD  
(c) APMC  
(d) NAFED

Ans.  (a)

Q.25 To which country India exported the most, before independence?
(a) Russia  
(b) Japan  
(c) Britain  
(d) USA

Ans.  (c)
Q.26  How much annual growth rate was targeted in Tenth Five Year Plan of India?
(a) 7 percent    (b) 8 percent
(c) 9 percent    (d) 10 percent
Ans.  (b)

Q.27  In which of the following states, election to the post of Sarpanch is made directly by the people?
1. Madhya Pradesh  
2. Gujarat  
3. Maharashtra
(a) Only 1    (b) Only 2 and 3
(c) 1, 2 and 3    (d) Only 1 and 3
Ans.  (c)

Q.28  Rural Infrastructure Development Fund (RIDF) was instituted by which of the following?
(a) NABARD  
(b) RBI  
(c) Government of India  
(d) Finance Ministry
Ans.  (c, a)
Ambiguous Question. Most appropriate answer will be (c).
Government of India created the RIDF in NABARD in 1995-96, with an initial corpus of Rs.2,000 crore.
Source:  https://www.nabard.org/content1.aspx?id=573&catid=8&mid=488

Q.29  The United States has recently declared an army called ‘Islamic Revolutionary Guard Corps’ as a terrorist organization. Which country is it related to?
(a) Iran  
(b) Pakistan  
(c) Syria  
(d) Afghanistan
Ans.  (a)

Q.30  Which of the following Lok Sabha Constituencies in Maharashtra had largest voters during 2019 general elections?
(a) Mumbai - South  
(b) Thane  
(c) Gadchiroli - Chimur  
(d) Ratnagiri - Sindhudurg
Ans.  (b)
Q.31  Who was elected the first woman President of Slovakia in 2019?
   (a) Nine Jorge   (b) Media Fox
   (c) Zuzana Caputova   (d) Eluna Lars

   Ans. (c)

Q.32  Maharashtra is celebrating birth centenary of three eminent personalities in 2019. They are
   (a) P.L. Deshpande – G.D. Madgulkar – Raja Paranjape
   (b) Baba Amte – P.L. Deshpande – Raja Navathe
   (c) Suchir Phadke – P.L. Deshpande – G.D. Madgulkar
   (d) Sudhir Phadke – Kumar Gandharva – P.K. Atre

   Ans. (c)

Q.33  2019 is the centenary year of the historical event of_________.
   (a) Formation of Indian Home Rule Society in London
   (b) Deportation of Tilak to Mandalay Jail
   (c) Salt Agitation
   (d) Jalianwala Bagh Massacre

   Ans. (d)

Q.34  Who was appointed the first Lokpal of India in 2019?
   (a) Justice Dipak Misra   (b) Justice Dilip Bhosale
   (c) Justice Ajaykumar Tripathi   (d) Justice Pinaki Chandra Ghose

   Ans. (d)

Q.35  What are the types of droughts as per ‘Krishi Ayog’ of India?
   (i) Meteorological drought, Hydrological drought, Agricultural drought.
   (ii) Meteorological drought, Hydrological drought.
   (iii) Agricultural drought, Intense drought, Hydrological drought
   (iv) Normal drought, Intense drought, Agricultural drought

   Which of the statements given above is/are correct?
   (a) Only (i)   (b) Only (ii) and (iii)
   (c) Only (i) and (ii)   (d) Only (iv)

   Ans. (a)
Q.36 Sardar Sarovar will provide water for irrigation to which of the following states?
(a) Gujarat – Madhya Pradesh   (b) Maharashtra – Gujarat
(c) Gujarat – Rajasthan        (d) Rajasthan – Punjab
Ans. (c)

Q.37 Write the name of social reformer who was impressed by writings of Thomas Paine.
(a) Gopal Ganesh Agarkar        (b) Dr. Babasaheb Ambedkar
(c) Justice Mr. Ranade          (d) Mahatma Jyotirao Phule
Ans. (d)

Q.38 Who resigned form the post of Finance Minister of India to support the Sanyuktta Maharashtra Movement?
(a) Yeshwantrao Chavan          (b) Balasaheb Kher
(c) C.D. Deshmukh               (d) K.M. Pannikar
Ans. (c)

Q.39 A severe earthquake occurred to Koyna on __________.
(a) 30 September, 1963          (b) 26 July, 1965
(c) 11 March, 1966              (d) 11 December, 1967
Ans. (d)

Q.40 Which of the following statements is/are INCORRECT?
(i) Pavnar city is located on the bank of river Katepurna.
(ii) The origin of river Wainganga is at Betul.
(iii) Terna is a tributary of river Manjira.
(a) Only (i)                    (b) Only (ii)
(c) (i) and (ii)                (d) (i), (ii) and (iii)
Ans. (c)

Q.41 The equal forces acting at right angle having resultant \( \sqrt{32} \), then find the magnitude of each force.
(a) 2                           (b) 4
(c) 8                           (d) 16
Ans. (b)
Q.42 Two unlike parallel forces, each of magnitude 50 kN are 200 mm apart from each other. What will be the magnitude of moment of couple formed by these two forces?
(a) 5 kN m (b) 10 kN m
(c) 20 kN m (d) 0
Ans. (b)

Q.43 When two surfaces are in contact with each other during motion, it requires more force even on horizontal surface to move which is due to friction. But frictional force does not depend on_______.
(a) Normal reaction from surface (b) Force tending to cause motion
(c) Roughness of surface (d) Area of contact between two surfaces
Ans. (d)

Source: Theory of Machines by SS Rattan [Page 279]

Q.44 The ratio of static friction to dynamic friction is always
(a) equal to one (b) less than one
(c) greater than one (d) None of the above
Ans. (c)

Q.45 What is the moment of inertia of a quarter circle with respect to x-axis which is passing through the centre of a circle whose radius is 20 mm?
(a) 3.14 cm$^4$ (b) 0.878 cm$^4$
(c) 0.785 cm$^4$ (d) 0.393 cm$^4$
Ans. (a)

Q.46 In three dimensional analysis, equilibrium of parallel forces along x-axis requires
(a) $\Sigma F_x = 0, \Sigma F_y = 0, \Sigma F_z = 0$ (b) $\Sigma F_x = 0, \Sigma M_y = 0, \Sigma M_z = 0$
(c) $\Sigma F_x = 0, \Sigma M_y = 0, \Sigma M_z = 0$ (d) $\Sigma F_x = 0, \Sigma F_y = 0, \Sigma M_z = 0$
Ans. (c)

Q.47 If a body acted upon by a number of co-planar non-concurrent forces it may
(a) rotate about itself without moving
(b) move in any one direction rotating about itself
(c) be completely at rest
(d) All of the above
Q.48 Radial component of velocity and acceleration in curvilinear motion are
(a) \( \dot{r} \) and \( \dot{r} - r(\dot{\theta})^2 \)  
(b) \( \dot{r} \) and \( \dot{r} \) \( \dot{\theta} - r \dot{\theta} \)  
(c) \( r \) and \( r \dot{\theta} \)  
(d) \( r \) and \( r \dot{\theta} \)  

Ans.  (a)

Q.49 If the horizontal range of a projectile is maximum then the angle of the projectile must be ________ with horizontal.
(a) 90°  
(b) 75°  
(c) 45°  
(d) 30°  

Ans.  (c)

Q.50 “The rate of change of momentum is directly proportional to the impressed force, and takes place in the same direction, in which the force acts”. This is the statement of __________.
(a) D’Alembert’s principle  
(b) Newton’s first law of motion  
(c) Newton’s second law of motion  
(d) Newton’s third law of motion  

Ans.  (c)

Q.51 Ball A of mass 1 kg moving with velocity of 2 m/s strikes directly on a ball of mass 2 kg rest. What are the velocities of the two balls after impact if coefficient of restitution is 0.5?
(a) 0 and 1 m/s  
(b) 1 and 2 m/s  
(c) 2 and 2 m/s  
(d) 1 and 1 m/s  

Ans.  (a)

Q.52 A ball which is thrown upward at an angle ‘\( \alpha \)’, returns to the ground describing a parabolic path during its flight  
(a) Vertical component of velocity constant  
(b) Horizontal component of velocity remains constant  
(c) Speed of the ball remains constant  
(d) Kinetic energy of the ball remains constant  

Ans.  (b)
Q.53 What will be the deformation of the spring if a block of weight 100 N kept on it. Take stiffness of spring 1000 N/m.
(a) 10 m  
(b) 0.1 m  
(c) 0.01 m  
(d) 1 m  
Ans. (b)

Q.54 If \( u_1 \) and \( u_2 \) are the velocities of two moving bodies in the same direction before impact and \( V_1 \) and \( V_2 \) are their velocities after impact, then coefficient of restitution is given by

\[
\begin{align*}
(a) & \quad \frac{V_1 - V_2}{u_1 - u_2} \\
(b) & \quad \frac{V_2 - V_1}{u_1 - u_2} \\
(c) & \quad \frac{u_1 - u_2}{V_1 - V_2} \\
(d) & \quad \frac{u_2 + u_1}{V_2 - V_1}
\end{align*}
\]

Ans. (b)

Q.55 How much is the carbon content(%) in high tensile steel?
(a) 0.7 – 0.9%  
(b) 0.3 – 0.5%  
(c) 0.6 – 0.8%  
(d) 0.8 – 1.0%  
Ans. (b)

High tensile steel (medium carbon steel), which is having carbon content more than low carbon steel with high yield strength. And % carbon composition is (0.30 to 0.45).

Source : Material Science and Metallurgy By U.C. Jindal [Page: 257-258]

Q.56 How much is the measuring capability of digital planimeter w.r.t. an ordinary planimeter?
(a) 10 times larger  
(b) 2 times larger  
(c) 20 times larger  
(d) 100 times larger  
Ans. (d)

Q.57 Type of surveying in which the shape of the earth is taken into account is known as
(a) Topographical survey  
(b) Cadastral survey  
(c) Geodetic surveying  
(d) Plane surveying  
Ans. (c)
Q.58 Out of the following, which is clay stone with vesicular texture?
(a) Laterite  (b) Sandstone  
(c) Limestone  (d) Granite

Ans.  (a)

Q.59 What is carbon content(%) in mild steel?
(a) 2.0 – 3.0  (b) 0.5 – 0.8  
(c) 0.05 – 0.1  (d) 0.15 – 0.3

Ans.  (c, d)
Mild steel which is low carbon steel having less than 0.30% carbon so there are two options correct under this category.

Source: Material Science and Metallurgy By U.C. Jindal [Page: 257]

Q.60 Out of the following, which is the component of G.I.S.?
(a) Computer system  (b) Software  
(c) Data management  (d) All of the above

Ans.  (d)

Q.61 By which rule, the total error in latitude and departure is distributed in proportion to the lengths of the traverse legs?
(a) Transit rule  (b) Bowditch’s rule  
(c) Third rule  (d) Simpson’s rule

Ans.  (b)

Q.62 What is the minimum live load (N/m²) of floor area to be considered for residential buildings?
(a) 3000  (b) 4000  
(c) 2000  (d) 5000

Ans.  (c)

Q.63 The component in cement which has the property of hydrating rapidly and is responsible to provide not only early strength but also the ultimate strength is
(a) Dicalcium silicate  (b) Tricalcium silicate  
(c) Tricalcium aluminate  (d) Tetra calcium aluminio ferrite
Ans. (b)

Q.64 In Ordinary Portland cement the percentage of lime constitutes:
(a) 60 to 67  
(b) 50 to 57  
(c) 74 to 78  
(d) 51 to 56  
Ans. (a)

Q.65 In a governor, the vertical distance which the sleeve travels due to change in equilibrium speed is called ________.
(a) Sleeve distance  
(b) Sleeve fit  
(c) Sleeve height  
(d) Sleeve lift  
Ans. (d)

Q.66 The thermal conductivity of _______ varies with square root of the absolute temperature.
(a) solid  
(b) liquid  
(c) gas  
(d) none of the above  
Ans. (c)

Q.67 Name the boiler which can generate superheated steam without additional accessories.
(a) Cornish boiler  
(b) Locomotive boiler  
(c) Lancashire boiler  
(d) Cochran boiler  
Ans. (c)  

Q.68 The power transmitted by belt drive is designed on the basis of
(a) angle of lap on the smaller pulley  
(b) angle of lap on the larger pulley  
(c) average angle of lap of two pulleys  
(d) angle of lap of the driver pulley whether smaller or larger  
Ans. (a)
Q.69  A four bar chain has
   (a) all turning pairs
   (b) all sliding pairs
   (c) one turning pair and others are sliding pairs
   (d) one sliding pair and others are turning pairs

   Ans.  (a)

Q.70  In low carbon steels, the presence of small quantities of sulphur improves
   (a) weldability          (b) formability
   (c) machinability       (d) hardenability

   Ans.  (c)

Q.71  ________ is the property of a material to resist fracture due to high impact blows like hammer blows.
   (a) fatigue          (b) creep
   (c) toughness        (d) malleability

   Ans.  (c)

Q.72  The casting produced by forcing molten metal under pressure into a permanent metal mould is called as ________ casting.
   (a) sand mould       (b) slush
   (c) die              (d) all of the above

   Ans.  (c)

Q.73  The process of removal of metal by rotating the cutter in the direction of travel of work piece is called
   (a) up milling       (b) down milling
   (c) straddle milling  (d) saw milling

   Ans.  (b)

Q.74  ________ is the process by which great pressure is applied to a heated metal billet or blank causing it to flow through a restricted orifice.
   (a) Extrusion         (b) Hot rolling
   (c) Tubing           (d) Cold rolling

   Ans.  (a)
Q.75 Find the current through resistor $R_4$ in the figure given below:

$E = 12 \text{ V}$

- $R_1 = 4 \Omega$
- $R_2 = 8 \Omega$
- $R_3 = 4/3 \Omega$
- $R_4 = 6 \Omega$

(a) 0.6 A  
(c) 0.5 A  
(b) 0.8 A  
(d) 1.0 A

Ans. (b)

Q.76 Number of equations required to be analyzed in a given network by nodal analysis is equal to
(a) The number of independent loops
(b) One less than the number of loops
(c) The number of nodes
(d) One less than the number of nodes

Ans. (d)

Q.77 Two capacitors of 80 $\mu$F and 50 $\mu$F are connected in series. Find the maximum energy stored in the circuit when 200 V at 50 Hz are applied across the series circuit.

(a) 1230 J  
(c) 123 J  
(b) 1.23 J  
(d) 980 J

Ans. (b)

Q.78 The admittance of a branch with $Z = 3 + j4$ ohm in an ac circuit is

(a) $(0.3 - j0.25)$mho  
(c) $(0.25 - j0.3)$mho  
(b) $(0.6 + j0.8)$mho  
(d) $(0.6 - j0.8)$mho
Ans. (*)

Given: Impedance, \( Z = 3 + j4 \)

The admittance, \( Y = \frac{1}{Z} = G + jB \)

\[
G = \frac{R}{R^2 + X^2} = \frac{3}{3^2 + 4^2} = \frac{3}{25} = 0.12
\]

\[
B = \frac{-X}{R^2 + X^2} = \frac{-4}{3^2 + 4^2} = \frac{-4}{25} = -0.16
\]

\[
\therefore \quad Y = 0.12 - j0.16
\]


---

Q.79 Which of the following 3-phase systems is sometimes also called as 3-phase 4-wire system?

(a) 3-phase star-connected
(b) 3-phase delta-connected
(c) 3-phase zig-zag connected
(d) any 3-phase system

Ans. (a)

---

Q.80 Three similar resistors are connected in star across 400 V, 3-phase lines. The line current is 5 A. Calculate the value of each resistor.

(a) 46.2 \( \Omega \)
(b) 80 \( \Omega \)
(c) 138.4 \( \Omega \)
(d) None of these

Ans. (a)

---

Q.81 In a transformer, maximum voltage regulation occurs at ________.

(a) leading power factor of the load
(b) lagging power factor of the load
(c) unity power factor of the load
(d) none of these

Ans. (b)
Q.82  The core of a transformer is assembled with thin laminated sheets so as to
(a) reduce hysteresis loss
(b) reduce eddy current loss
(c) reduce both hysteresis and eddy current losses
(d) ensure good magnetic coupling between primary and secondary winding

Ans.  (b)

Q.83  When a transformer is operating on no load the primary applied voltage is approximately balanced by
a. primary induced emf
b. secondary induced emf
c. terminal voltage across the secondary
d. voltage drop across the resistance and reactance
Which statements is/are correct?
(a) a only  (b) a and b
(c) c and d  (d) d only

Ans.  (a)

Q.84  The resistance and reactance in a series R-C circuit are 7.5Ω each. In this circuit
(a) voltage leads the current by 45°
(b) current leads the voltage by 45°
(c) voltage leads the current by 60°
(d) current leads the voltage by 15°

Ans.  (b)

Q.85  Find the Eigen values and Eigen vectors of the following matrix

\[
\begin{bmatrix}
-5 & 2 \\
2 & -2
\end{bmatrix}
\]

(a) \((-1, 6) \begin{bmatrix} 1 \\ -1 \end{bmatrix}\)  (b) \((1, 6) \begin{bmatrix} 1 \\ -2 \end{bmatrix}\)

(c) \((-1, 6) \begin{bmatrix} -1 \\ -2 \end{bmatrix}\)  (d) \((-1, 6) \begin{bmatrix} 1 \\ 2 \end{bmatrix}\)

Ans.  (a)
Q.86 Which of the following is the inverse of the matrix \( A = \begin{bmatrix} 3 & 0 \\ 1 & 2 \end{bmatrix} \)

(a) \( \begin{bmatrix} 1 & 0 \\ \frac{1}{3} & 1 \\ \frac{1}{6} & 2 \end{bmatrix} \)  
(b) \( \begin{bmatrix} 0 & 1 \\ \frac{1}{6} & 1 \\ \frac{1}{6} & 2 \end{bmatrix} \)

(c) \( \begin{bmatrix} 1 & -1 \\ \frac{1}{6} & 1 \\ \frac{1}{6} & 2 \end{bmatrix} \)  
(d) \( \begin{bmatrix} 1 & 1 \\ \frac{1}{3} & 0 \\ 0 & 1 \end{bmatrix} \)

Ans. (a)

Q.87 Pick up the incorrect statement from the following options.
If \( A \) is Coefficient Matrix, \( K \) is Augmented Matrix and \( R \) is the Rank of Matrix.
(a) If \( R(A) \neq R(K) \), the equations are inconsistent and have no solutions
(b) If \( R(A) = R(K) = n \), the equations are inconsistent and have unique solutions
(c) If \( R(A) = R(K) < n \), the equations are inconsistent and have infinite number of solutions
(d) If \( R(A) = R(K) > n \), the equations are consistent and have infinite number of solutions

Ans. (d)

Q.88 If \( u = x^y \) choose the correct option

(a) \( \frac{\partial^2 u}{\partial x^2 \partial y} = \frac{\partial^2 u}{\partial x \partial y \partial x} \)  
(b) \( \frac{\partial^2 u}{\partial x \partial y^2} = \frac{\partial^2 u}{\partial y \partial x \partial y} \)

(c) \( \frac{\partial^2 u}{\partial x \partial y^2} = \frac{\partial^2 u}{\partial x^2 \partial y} \)  
(d) \( \frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial y^2} \)

Ans. (a)

Q.89 A function \( f(x, y) \) is said to be homogeneous of degree \( n \) in the variables \( x \) and \( y \) if it can be expressed in the form

(a) \( x^n \phi \left( \frac{y}{x} \right) \)  
(b) \( y^n \phi \left( \frac{x}{y} \right) \)

(c) Both (a) and (b)  
(d) None of the above

Ans. (c)
Q. 90 Choose the correct option for the following sentences:

1. A function \( f(x, y) \) is said to have a maximum value at \( x = a, y = b \) if \( f(a, b) > f(a + h, b + k) \).
2. A function \( f(x, y) \) is said to have a maximum value at \( x = a, y = b \) if \( f(a, b) < f(a + h, b + k) \).

(a) Both 1 and 2 are wrong  (b) Both 1 and 2 are true
(c) 1 is true, 2 is wrong  (d) 2 is true, 1 is wrong

Ans.  (c)

Q. 91 Match the following:

A. \[ \frac{\partial^2 u}{\partial t^2} = C \frac{\partial^2 u}{\partial x^2} \]  I. Two-dimensional Poisson equation
B. \[ \frac{\partial u}{\partial t} = C \frac{\partial^2 u}{\partial x^2} \]  II. One-dimensional wave equation
C. \[ \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0 \]  III. One-dimensional heat equation
D. \[ \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = f(x, y) \]  IV. Two-dimensional Laplace equation

A  B  C  D
(a)  II  III  I  IV
(b)  II  III  IV  I
(c)  IV  I  III  II
(d)  IV  III  II  I

Ans.  (b)

Q. 92 Particular integral of

\[ \frac{d^2 y}{dx^2} + 3 \frac{dy}{dx} + 2y = 5 \]

(a) \( \frac{2}{5} \)  (b) \( \frac{1}{5} \)
(c) \( \frac{5}{2} \)  (d) \( \frac{3}{2} \)

Ans.  (c)
Q.93 Cauchy’s linear differential equation \( x^n \frac{d^n y}{dx^n} + a_{n-1} x^{n-1} \frac{d^{n-1} y}{dx^{n-1}} + \ldots + a_n y = f(x) \) can be reduced to linear differential equation with constant coefficient by using substitution

(a) \( x = e^z \)  
(b) \( y = e^z \)  
(c) \( z = e^y \)  
(d) \( z = e^y \)

**Ans.** (a)

---

Q.94 To reduce the differential equation \((x + 5)^2 \frac{d^2 y}{dx^2} - (x + y) \frac{dy}{dx} + y = 10x + 8\) to linear differential equation with constant coefficient, the substitution is

(a) \( x + 5 = e^z \)  
(b) \( x + 5 = e^y \)  
(c) \( z = e^{x+5} \)  
(d) \( z = x + 5 \)

**Ans.** (b)

---

Q.95 Given that

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<th>( x )</th>
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<th>4.4</th>
<th>4.6</th>
<th>4.8</th>
<th>5.0</th>
<th>5.2</th>
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<td>( \log x )</td>
<td>1.3863</td>
<td>1.4351</td>
<td>1.4816</td>
<td>1.5261</td>
<td>1.5686</td>
<td>1.6094</td>
<td>1.6484</td>
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</tbody>
</table>

Evaluate \( \int_{4}^{5.2} \log x \, dx \) by trapezoidal rule

(a) \( 1.827887 \)  
(b) \( 1.827655 \)  
(c) \( 1.827867 \)  
(d) \( 1.82780 \)

**Ans.** (b)
Q.96  Given that

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<tr>
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<td>0.2</td>
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<tr>
<td>5</td>
<td>0.0385</td>
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<tr>
<td>6</td>
<td>0.027</td>
</tr>
</tbody>
</table>

Evaluate \( \int_0^6 \frac{dx}{1+x^2} \) using Simpson's \( \frac{3}{8} \) rule.

(a) 1.3574        (b) 1.3569
(c) 1.3576        (d) 1.3571

Ans. (d)

Q.97  The triple integral is used to compute

(a) Volume        (b) Area
(c) Both Volume and area       (d) None of these

Ans. (a)

Q.98  Evaluate

\[ \int_0^1 \int_{x^2}^1 x \, dx \, dy \]

(a) \( \frac{2}{35} \)
(b) \( \frac{4}{35} \)
(c) \( \frac{4}{17} \)
(d) \( \frac{2}{17} \)

Ans. (b)
Q.99 Change the order the integration in
\[ \int_{0}^{a} \int_{0}^{a} \frac{x}{x^2 + y^2} \, dx \, dy \]

(a) \[ \int_{0}^{a} \int_{0}^{a} \frac{x}{y^2 + x^2} \, dy \, dx \]  
(b) \[ \int_{0}^{a} \int_{0}^{a} \frac{x}{x^2 + y^2} \, dy \, dx \]  
(c) \[ \int_{0}^{a} \int_{0}^{a} \frac{x}{x^2 + y^2} \, dx \, dy \]  
(d) \[ \int_{0}^{a} \int_{0}^{a} \frac{x}{y^2 + x^2} \, dy \, dx \]  

Ans. (a)  

Q.100 Evaluate the following integral \[ \int_{0}^{a} \int_{0}^{a} \int_{0}^{a} (xy + xz + yz) \, dx \, dy \, dz \]

(a) \[ \frac{3}{4} a^3 \]  
(b) \[ \frac{2}{3} a^5 \]  
(c) \[ \frac{3}{4} a^5 \]  
(d) \[ \frac{5}{3} a^3 \]  

Ans. (c)