BPSC AE
Paper-IV

Previous Year Paper
(General Engineering Science) 14 Oct 2022

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Booklet Series

A

Serial No. 100074

Roll Number

Question Booklet

Paper—IV

GENEI SCIENCE

(Objective)

Time Allowed : 1 Hour

Maximum Marks : 100

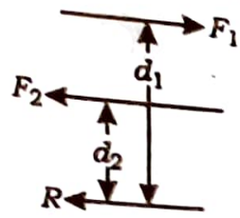
Read the following instructions carefully before you begin to answer the questions.

IMPORTANT INSTRUCTIONS

1. This Question Booklet contains **50** questions in all.
2. **All** questions carry equal marks.
3. Attempt **all** questions.
4. **Immediately after commencement of the examination, you should check up your Question Booklet and ensure that the Question Booklet Series is printed on the top right-hand corner of the Booklet. The Booklet contains 12 printed pages and no page or question is missing or unprinted or torn or repeated. If you find any defect in this Booklet, get it replaced immediately by a complete Booklet of the same series.**
5. You must write your Roll Number in the space provided on the top of this page. Do not write anything else on the Question Booklet.
6. An Answer Sheet will be supplied to you separately by the Invigilator to mark the answers. **You must write your Name, Roll No. and other particulars on the first page of the Answer Sheet provided, failing which your Answer Sheet will not be evaluated.**
7. You will encode your **Roll Number** and the **Question Booklet Series A, B, C or D** as it is printed on the top right-hand corner of this Question Booklet with Black/Blue ballpoint pen in the space provided on **Page–2** of your Answer Sheet. **If you do not encode or fail to encode the correct series of your Question Booklet, your Answer Sheet will not be evaluated correctly.**
8. Questions and their responses are printed in English only in this Booklet. Each question comprises **four** responses—(A), (B), (C) and (D). You are to select ONLY ONE correct response and mark in your Answer Sheet. In case you feel that there are more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each question. Your total marks will depend on the number of correct responses marked by you in the Answer Sheet.
9. In the Answer Sheet, there are **four** brackets—(A), (B), (C) and (D) against each question. To answer the questions you are to **mark with Black/Blue ballpoint pen** ONLY ONE bracket of your choice for each question. Select one response for each question in the Question Booklet and mark in the Answer Sheet. If you mark more than one answer for one question, the answer will be treated as wrong. **Any erasure or change is not allowed.**
10. You should not remove or tear off any sheet from the Question Booklet. You are not allowed to take this Question Booklet and the Answer Sheet out of the Examination Hall during the examination. **After the examination has concluded, you must hand over your Answer Sheet to the Invigilator.** Thereafter, you are permitted to take away the Question Booklet with you.
11. Failure to comply with any of the above instructions will render you liable to such action or penalty as the Commission may decide at their discretion.

SEAL

1. Two unlike parallel forces are shown in the following figure :



The resultant R can be located by the relation

(A) $d_1 \times d_2 = F_1 \times F_2$

(B) $F_1 \times d_2 = F_2 \times d_1$

(C) $F_1 / d_1 = F_2 / d_2$

(D) $F_1 \times d_1 = F_2 \times d_2$

2. On a ladder resting on a smooth ground and leaning against rough vertical wall, the force of friction acts

(A) upward at its upper end

(B) toward the wall at the upper end

(C) toward the wall at lower end

(D) downward at its upper end

3. A circular disc rotating with constant angular speed of 5 rad/s, moves along a straight line. The mass and the radius of the disc are 10 kg and 1·0 m respectively. The total kinetic energy possessed by the disc will be

(A) 187·5 N-m

(B) 125 N-m

(C) 62·5 N-m

(D) 250 N-m

4. If the tension in the cable supporting the lift moving upwards is twice the tension when the lift is moving downwards, the acceleration of the lift is equal to

(A) $g/2$

(B) $g/3$

(C) $g/4$

(D) $g/5$

5. Which of the following equipments can be used for construction work like—to clear the site of work, to make the land level, etc.?

(A) Scraper

(B) Grader

(C) Excavator

(D) Bulldozer

6. Size of a theodolite is specified by

(A) the length of telescope

(B) the diameter of vertical circle

(C) the diameter of lower plate

(D) the diameter of upper plate

7. Which of the following is ***not*** used in total station equipment?

(A) Battery

(B) Serial cable

(C) Memory card

(D) Alidade

8. Repeatability of the instrument with respect to a given fixed input is

(A) accuracy

(B) precision

(C) resolution

(D) sensitivity

9. LVDT works on the principle of

(A) variable resistance

(B) variable mutual induction

(C) variable self-induction

(D) variable capacitance

10. The basic unit in angular measurement is

(A) degree

(B) minute

(C) second

(D) right angle

11. Universal surface gauge is used

(A) for flatness testing

(B) for layout work and inspection

(C) for measuring profile of complex surface

(D) for measuring surface roughness

12. Mohr's circle construction is valid for both stress as well as the area moment of inertia because

(A) both are tensors of first-order

(B) both are tensors of second-order

(C) both are axial vectors

(D) both occur under plane stress condition

13. A solid steel shaft of 100 mm diameter and 1·0 m long is subjected to a twisting moment T. This shaft is to be replaced by a hollow shaft having outer and inner diameter as 100 mm and 50 mm respectively. If the maximum shear stress induced in both the shafts is same, the twisting moment T transmitted by hollow shaft must be reduced by

(A) $T/4$
(B) $T/8$
(C) $T/16$
(D) $T/12$

14. The stresses induced in a shaft due to bending and torsion load are 80 MPa and 30 MPa respectively. The yield strength of the shaft material is 280 MPa. Using maximum shear stress theory, the factor of safety will be

(A) 2·54
(B) 3·4
(C) 5·6
(D) 2·8

15. A column of length L has one end hinged and other fixed. The cross-section of the column is a circle of diameter D. The slenderness ratio of the column is

(A) $\sqrt{2}L/D$
(B) $2\sqrt{2}L/D$
(C) $2L/D$
(D) $4L/D$

16. The common household glass is

(A) soda-lime glass
(B) borosilicate glass
(C) high silica glass
(D) lead glass

17. Which one of the following timbers is used for sports goods?

(A) Mulberry
(B) Mahogany
(C) Sal
(D) Deodar

18. Ball bearings are generally made of

(A) cast iron
(B) malleable cast iron
(C) carbon steel
(D) carbon-chrome steel

19. The alloy used for manufacture of food processing machinery is

(A) Inconel

(B) Monel metal

(C) Duraluminium

(D) Babbit metal

20. Copper has FCC structure, its atomic radius is 1·28 Å and atomic mass is 63·5. The density of copper will be

(A) $8.9\times10^{3}\ kg/mm^{3}$

(B) $8.9\times10^{3}\ kg/cm^{3}$

(C) $8.9\times10^{3}\ kg/m^{3}$

(D) $8.9\times10^{3}\ g/mm^{3}$

21. In works management, theory of transactional analysis (TA) is applied to determine the

(A) feasibility of project

(B) cause of behaviour of personnel

(C) time taken for each activity

(D) best layout

22. A PERT network has three activities on critical path with mean time 3, 8 and 6, and standard deviation 1, 2 and 3 respectively. The probability that the project will be completed in 20 days is

(A) 0·50

(B) 0·66

(C) 0·84

(D) 0·95

23. Depreciation of machines is categorized under the head

(A) direct expenses

(B) indirect expenses

(C) administrative expenses

(D) indirect material costs

24. Bernoulli's theorem is applicable for

(A) streamline flow

(B) turbulent flow

(C) normal flow

(D) perfect incompressible fluid flowing in continuous streams

25. The continuity equation

(A) requires that Newton's second law of motion be satisfied at every point in fluid

(B) relates the momentum per unit volume for two points on a streamline

(C) expresses the relation between energy and work

(D) relates mass rate of flow along a streamline

26. Head loss in turbulent flow in a pipe

(A) varies directly as velocity

(B) varies inversely as square of velocity

(C) depends upon orientation of pipe

(D) varies inversely as velocity

27. Heat transfer takes place as per

(A) zeroth law of thermodynamics

(B) second law of thermodynamics

(C) Kirchhoff's law

(D) Stefan's law

28. A gray body is one whose absorptivity

(A) varies with temperature

(B) varies with the wavelength of incident ray

(C) does not vary with temperature and wavelength of the incident ray

(D) There is no such criterion

29. According to the first law of thermodynamics

(A) mass and energy are mutually convertible

(B) Carnot engine is most efficient

(C) heat and work are mutually convertible

(D) mass and light are mutually convertible

30. According to Clausius statement

(A) heat flows from hot substance to cold substance

(B) heat flows from very hot substance to cold substance

(C) heat cannot flow from cold substance to hot substance

(D) heat can flow from cold substance to hot substance with the aid of external work

31. The air standard efficiency of an Otto cycle compared to diesel cycle for the given compression ratio is

(A) same

(B) less

(C) more

(D) more or less depending on power rating

32. Reaction turbines are used for

(A) low head

(B) high head

(C) high head and low discharge

(D) low head and high discharge

33. If H is manometric height in metres, Q the discharge in m^3/sec and η the overall efficiency of pump and ρ density of fluid, then power to drive centrifugal pump is equal to

(A) $\frac{\rho QH}{75\eta}$

(B) $\frac{\rho QH\eta}{75}$

(C) $\frac{QH\eta}{75}$

(D) $\frac{QH\eta}{75\eta}$

34. A series combination of three capacitors having capacitance values of 4 μF, 5 μF and 8 μF is connected across a potential of 230 V. The charge on each capacitor is

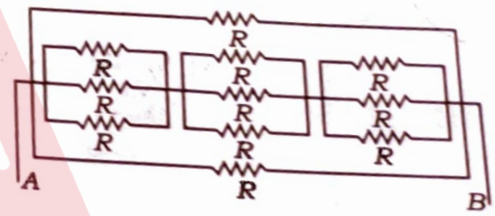
(A) 122×10^{-6} C

(B) 132×10^{-6} C

(C) 151×10^{-6} C

(D) 161×10^{-6} C

35. The value of resistance between points A and B is



(A) $3R$

(B) R

(C) $R/3$

(D) $R/9$

36. The value of resistance of each element in a star network is $R/3$. Then the value of resistance of each element for its equivalent delta network is

(A) R

(B) $3R$

(C) $R/6$

(D) $R/9$

37. Two coils are connected in parallel and a voltage of 300 volts is applied on the terminal. The total current taken is 30 ampere and the power dissipated in one of the coils is 1600 W. Determine the resistance of each coil and select the appropriate option.

(A) 10·5 ohm

(B) 11·11 ohm

(C) 12·16 ohm

(D) 13·5 ohm

38. If equalizer bar is not used in two parallel connected compound DC generators, then

(A) one of the generators may run as a motor

(B) both the generators may stop

(C) one of the generators may stop

(D) both the generators may start hunting

39. 1-phase transformers having 400 kVA each, when tested by the Sumpner's test (back-to-back test) gave the following results :

$W1$ in the supply line 8 kW,
$W2$ in the secondary series circuit, when full load current circulated through the secondaries 12 kW

Determine the efficiency of each transformer and select the correct option.

(A) 94·8%

(B) 97·56%

(C) 98·56%

(D) 96·7%

40. Find the value of R for the maximum power transfer to the load.

(A) 5

(B) 6·5

(C) 7·7

(D) 8·1

41. Two coils are connected in series and their effective inductance is found to be 20 H. When the connections of one coil are reversed, the effective inductance is 6 H. If the coefficient of coupling is 0·6, then the self-inductance of each coil and the mutual inductance will be

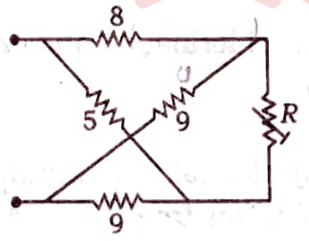
(A) $M = 2{\cdot}5$ and $L1 = 12$, $L2 = 3$

(B) $M = 3{\cdot}5$ and $L1 = 12$, $L2 = 3$

(C) $M = 3{\cdot}5$ and $L1 = 13{\cdot}09$, $L2 = 1{\cdot}91$

(D) $M = 2{\cdot}5$ and $L1 = 13{\cdot}09$, $L2 = 1{\cdot}91$

42. A graph of a network has 8 nodes and 5 independent loops. The number of branches of the graph is



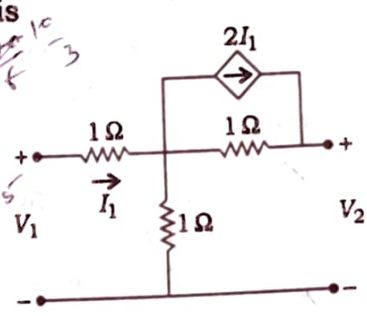
(A) 11

(B) 12

(C) 13

(D) 14

43. In the two-port network shown below, the h_{11} parameter (where $h_{11} = V_1 / I_1$ when $V_2 = 0$) in ohm is



(A) 1

(B) 3

(C) 0·5

(D) 2

44. A series *R-L-C* circuit is connected across a 240 V, 50 Hz supply. When the voltage across capacitor is 250 V, a maximum current of 0·5 A flows in the circuit. Find the inductance.

(A) 6·37 μF

(B) 2·25 μF

(C) 0·47 μF

(D) 1·58 μF

45. A 200 V DC shunt motor develops a torque of 54 N-m at an armature current 10 A. The torque produced when the armature current is 20 A, is

(A) 54 N-m

(B) 81 N-m

(C) 108 N-m

(D) 75 N-m

46. A synchronous motor and an alternator are delivering about 5% of their rated power at unity power factor. If these machines are loaded to their rated capacity, then their armature currents

(A) decrease, motor operates at lagging power factor and alternator at leading power factor

(B) increase, motor operates at leading power factor and alternator at lagging power factor

(C) increase, both operates at lagging power factor

(D) increase, motor operates at lagging power factor and alternator at leading power factor

47. Power is measured in a three-phase load by two-wattmeter method. The reading of one-wattmeter is 5000 W and the other wattmeter deflects in reverse direction. On inter-changing the potential terminals, the second wattmeter reads 1000 W. The total power consumed by the load is

(A) 5000 W

(B) 4000 W

(C) 6000 W

(D) 1000 W

48. The main pollutants emitted from automobiles are

(A) carbon monoxide, nitrogen oxides and hydrocarbons

(B) carbon dioxide, nitrogen oxides and hydrocarbons

(C) carbon monoxide, sulphur dioxides and hydrocarbons

(D) carbon monoxide, sulphur dioxides and nitrogen oxides

49. The common method adopted for disinfection or drinking water, employed in home application is by using filters and

(A) UV radiation

(B) chlorination

(C) ozonization

(D) chlorination and ozonization

50. Taj Mahal is threatened by pollution from

(A) chlorine

(B) sulphur dioxide

(C) nitrogen dioxide

(D) carbon monoxide