

Q.B. Series:

**A****Common Entrance Test (Engineering) - 2017  
QUESTION BOOKLET****INSTRUCTIONS**

Q.B. Number:

**500205**

Maximum Time Allowed : 3 Hours

No. of Questions: 180

Negative Marking : 0.25

Maximum Marks: 180

Roll Number:

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Answer Sheet Number:

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Please read the following instructions carefully:

1) **Check the booklet thoroughly:** In case of any defect – Misprint, missing question(s) or duplication of question(s) / Page(s), get the booklet changed with the booklet of the same series from the Room Invigilator. No complaint shall be entertained after the entrance test.

2) Write your Roll Number and the OMR Answer Sheet Number on the question booklet.

3) Mark carefully your Roll Number, Question Booklet Number, Paper Code, Question Booklets series and Course on the OMR Answer sheet and sign at the appropriate place. If you have committed any mistake in making these entries, you must immediately report to the Room Invigilator. You can also make representation to the Controller of Examinations within 3 days after conclusion of the test for rectifying this mistake, failing which no such claim will be entertained afterwards.

4) Strictly follow the instructions given by the Centre Supervisor / Room Invigilator and those given on the Question Booklet.

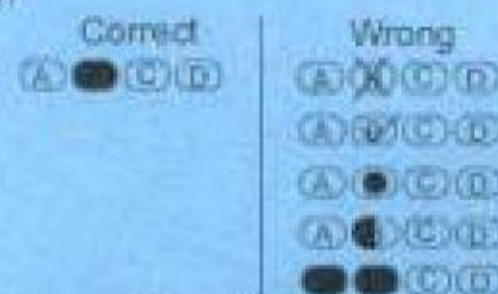
5) Candidates are not allowed to carry any papers, notes, books, calculators, cellular phones, scanning devices, pagers etc. to the Examination Hall. Any candidate found using, or in possession of such unauthorized material, indulging in copying or impersonation or adopting unfair means / reporting late / without Admit Card will be debarred from the written test.

6) Please mark the right responses on the OMR Sheet with **ONLY** a Blue/Black ball point pen. Use of eraser, whitener (fluid) and cutting on the OMR Answer Sheet is **NOT** allowed.

7) The test is of objective type containing multiple choice questions (MCQs). Each objective question is followed by four responses. Your task is to choose the correct/best response and mark your response on the OMR Answer Sheet and **NOT** on the Question Booklet.

8) There will be **0.25** negative marking for every wrong answer.

9) For marking response to a question, completely darken the **CIRCLE** so that the alphabet inside the **CIRCLE** is not visible. Darken only **ONE** circle for each question. If you darken more than one circle, it will be treated as wrong answer. The **CORRECT** and the **WRONG** methods of darkening the **CIRCLE** on the OMR Answer Sheet are shown below.



10) Please be careful while marking the response to questions. The response once marked cannot be changed and if done shall be treated as wrong answer.

11) In view of the tight time span, do **NOT** waste your time on a question which you find to be difficult. Attempt easier questions first and come back to the difficult questions later during the test.

12) **DO NOT** make any stray marks anywhere in or around the oval on the OMR Answer Sheet. It will be read as double shading and will make answer invalid. **DO NOT** fold or wrinkle the OMR Answer Sheet.

13) Rough work **MUST NOT** be done on the OMR Answer Sheet. Use your test booklet for this purpose.

14) Candidates are provided carbonless OMR Answer Sheet having original copy and candidate's copy. After completing the examination, candidates are directed to fold at perforation on the top of the sheet, tear it to separate original copy and candidate's copy and then hand over the original copy of OMR Answer Sheet to the Room Invigilator and take candidate's copy with them.

**DO NOT OPEN THE SEAL OF THIS BOOKLET UNTIL TOLD TO DO SO**

## Section 1 - Physics

1) In a Young's double slit experiment, the two slits which are separated by 1.2 mm are illuminated with a monochromatic light of wavelength 6000 angstrom. The interference pattern is observed on a screen placed at a distance of 1m from the slits. Find the number of bright fringes formed over 1 cm width on the screen

- A) 25  
B) 12  
C) 15  
D) 20

2) The energy stored in an inductor of "L" henry when it carries a current of "I" ampere is

- A)  $LI^2$   
B)  $(1/2) LI$   
C)  $L^2I^2$   
D)  $(1/2) LI^2$

3) A body of mass 5 kg acquires an angular acceleration of  $10 \text{ rad/s}^2$  by an applied torque of 2 Nm. Find its radius of gyration.

- A) 2.5 m  
B)  $\sqrt{2.5}$  m  
C)  $\sqrt{0.2}$  m  
D) 0.2 m

4) The deflections produced by a Tangent Galvanometer at two different places when the same current is passed through it are  $45^\circ$  and  $60^\circ$  respectively. The ratio of the values of  $B_H$  at two places is

- A)  $\sqrt{3} : 1$   
B)  $1 : \sqrt{3}$   
C)  $\sqrt{2} : 1$   
D)  $1 : \sqrt{2}$

5) The kinetic energy of electron and photon are the same. The relation between their De-Broglie wavelengths  $\lambda_e$  and  $\lambda_p$  is

- A)  $\lambda_e = \lambda_p$   
B)  $\lambda_e < \lambda_p$   
C)  $\lambda_e > \lambda_p$   
D)  $\lambda_e = 2\lambda_p$

6) If  $B_H = 4 \times 10^{-5} \text{ T}$  and  $B_V = 2 \times 10^{-5} \text{ T}$ , then the Earth's total field at the place is (in T):

- A)  $6 \times 10^{-5} \text{ T}$   
B)  $2\sqrt{5} \times 10^{-5} \text{ T}$   
C)  $4 \times 10^{-5} \text{ T}$   
D)  $3 \times 10^{-5} \text{ T}$

7) Two simple pendulums of lengths in the ratio 4:1 start oscillating at  $t=0$ . They will again be in phase after the shorter pendulum has made "n" oscillations. Find the value of n.

- A) 2  
B) 1.5  
C) 2.5  
D) 1

8) A cell of negligible internal resistance and emf 2.5 V is connected to a series combination of  $1 \Omega$ ,  $1 \Omega$  and  $3\Omega$ . The potential difference across  $3\Omega$  resistance is

- A) 7.5 V  
B) 2 V  
C) 1.5 V  
D) 2.5 V

9) A body A thrown vertically upwards with a velocity "v" reaches a height of 200 m. Another body B whose mass is twice that of A is thrown with a velocity 2v. Find the maximum height reached by B.

- A) 400 m  
B) 800 m  
C) 100 m  
D) 200 m

10) A conveyer belt moves at a steady rate of 2m/s. Sand is poured on the belt at 5 kgm/s. Find the constant force required to maintain the speed of the belt.

- A) 3 N  
B) 7 N  
C) 2.5 N  
D) 10 N

11) A bird flies at an angle of  $60^\circ$  to the horizontal. Its horizontal component of velocity is 10 m/s. Find its vertical component of velocity in m/s.

- A)  $10\sqrt{3}$   
B)  $10/\sqrt{3}$   
C) 5  
D) 26

12) Matter waves are

- A) mechanical waves  
B) electromagnetic waves  
C) photons  
D) waves associated with a moving particle under suitable conditions



13) A projectile is fired at an angle of  $45^\circ$  and reaches the highest point in its path after  $2\sqrt{2}$  s. Find the velocity of projectile in m/s.

- A) 19.6
- B) 39.2
- C) 9.8
- D) 4.9

14) The electric intensity and electric potential at a certain distance "r" from a point charge in air are 150 V/m and 300 V respectively. Find the distance "r".

- A) 2 m
- B) 4 m
- C) 0.5 m
- D) 0.4 m

15) Two planets are at distances  $R_1$  and  $R_2$  from the Sun. Their periods are  $T_1$  and  $T_2$ .  $(T_1/T_2)^2$  is equal to

- A)  $R_1 / R_2$
- B)  $(R_1 / R_2)^2$
- C)  $(R_1 / R_2)^3$
- D)  $(R_2 / R_1)^3$

16) Twelve wires, each of resistance  $2\Omega$  are connected to form a cube. Find the equivalent resistance between the adjacent corners of any face of the cube

- A)  $6/7 \Omega$
- B)  $7/6 \Omega$
- C)  $3/4 \Omega$
- D)  $4/3 \Omega$

17) The transistor parameters, namely  $\alpha$  and  $\beta$  of a transistor are related as

- A)  $1/\alpha + 1/\beta = 1$
- B)  $1/\alpha = \beta + 1/\beta$
- C)  $1/\alpha - 1/\beta = 0$
- D)  $1/\alpha - 1/\beta = 1$

18) The motion of a particle is represented by the equation  $S = 8t^3 - 2t^2 + 6t + 7$ . Find the velocity of the particle at the end of 2 seconds in m/s.

- A) 108
- B) 57
- C) 94
- D) 41

19) A graph of pressure (P) against volume (V) of an ideal gas undergoing an isothermal process is

- A) a straight line passing through the origin
- B) a parabola
- C) a rectangular hyperbola
- D) a straight line parallel to pressure axis

20) "n" identical capacitors are joined in parallel and charged to a potential V. The charged capacitors are disconnected and then connected in series using insulating handles such that the positive plate of one is connected to the negative plate of the other. The potential difference across the free plates of the combination is

- A) V
- B)  $V/n$
- C)  $nV$
- D)  $(n+1)V$

21) When a simple pendulum is moved from the Earth's surface to deep mine, the period of oscillation

- A) remains the same
- B) decreases
- C) increases
- D) becomes zero

22) The dimensional formula  $[ML^2T^{-2}]$  represents

- A) moment of force
- B) force
- C) acceleration
- D) momentum

23) 64 identical water droplets combine to form a large drop. Find the ratio of the total surface energy of 64 droplets to that of the large drop.

- A) 64 : 1
- B) 4 : 1
- C) 8 : 1
- D) 1 : 8

24) Four point charges of  $+3 \mu\text{C}$ ,  $+2 \mu\text{C}$ ,  $+3 \mu\text{C}$  and  $+2 \mu\text{C}$  are placed at the corners of a rectangle A, B, C and D. The electrical force will be least between the charges

- A) A and D
- B) B and D
- C) A and C
- D) C and D

25) An ideal Carnot's engine works between  $227^\circ$  and  $57^\circ$  C. Find the efficiency of the engine.

- A) 22%
- B) 34%
- C) 55%
- D) 13.5%

26) A lift moves vertically up with an acceleration "a". Force exerted by a person of mass M on the floor of the lift is

- A)  $Ma$
- B)  $Mg$
- C)  $M(g + a)$
- D)  $M(g - a)$



27) A transistor is preferred to a triode valve in amplifier circuit because it

- A) can withstand larger changes in temperature
- B) has higher input resistance
- C) can handle larger voltages
- D) is compact and does not require a heater

28) The electric intensities at a point due to two point charges in the x-y plane are  $3\mathbf{i} - 2\mathbf{j}$  and  $-2\mathbf{i} + 4\mathbf{j}$ . The magnitude of the resultant intensity at that point is

- A) 2.08 V/m
- B) 2.24 V/m
- C) 1.8 V/m
- D) 3.5 V/m

29) A body of mass 2 kg is thrown vertically up so that its kinetic energy is 490 J. ( $g = 9.8 \text{ m/s}^2$ ). The height at which the kinetic energy becomes half the original value is

- A) 10 m
- B) 12.5 m
- C) 25 m
- D) 50 m

30) A converging lens has a focal length of 0.12m. To get an image of unit magnification the object should be placed at what distance from the converging lens?

- A) 0.24 m
- B) 0.12 m
- C) 0.06 m
- D) 0.4 m

31) A solid cylinder of mass M and radius R rolls on a flat surface. Find its moment of inertia about the line of contact.

- A)  $(3/2) MR^2$
- B)  $MR^2$
- C)  $2 MR^2$
- D)  $(2/3) MR^2$

32) A coil of inductance L is divided into four equal parts and all the parts are connected in parallel. The effective inductance of the combination is

- A) L/4
- B) L/8
- C) L/16
- D) 4L

33) The kinetic energy of a body is increased by 300%. Its momentum increases by

- A) 100 %
- B) 150 %
- C) 200 %
- D) 300 %

34) The angular position of the first minimum is of diffraction pattern is

- A)  $\lambda/2a$
- B)  $a/\lambda$
- C)  $\lambda/a$
- D)  $2\lambda/a$

35) A very long conductor carries a current of 1A. The magnetic field at a point whose distance is 0.1m from one end of the conductor is (in T)

- A)  $10^{-7}$
- B)  $2 \times 10^{-6}$
- C)  $10^{-3}$
- D)  $10^{-2}$

36) Pick out the correct statement from the following

- A) The  $\beta$  of a refrigerator is higher when the difference in temperature between the inside and outside regions is smaller
- B) The value of  $\beta$  may be much higher than 100%
- C) As the refrigerator works,  $\beta$  increases due to the formation of ice
- D) It is necessary to defrost the refrigerator to increase the value of  $\beta$

37) Find the percentage increase in resistance of a wire when it is stretched uniformly so that its length increases by 0.5 %.

- A) 1%
- B) 2%
- C) 2.5%
- D) 3%

38) Digital circuits can be made with the repetitive use of

- A) OR gates
- B) AND gates
- C) NOT gates
- D) NAND gates

39) The absolute temperature of a gas is increased to 16 times of the original temperature. The rms speed of its molecules will become

- A) 4 times
- B) 16 times
- C) 64 times
- D) 256 times

40) The velocity of escape on a planet whose radius is  $1.7 \times 10^7 \text{ m}$  and acceleration due to gravity is  $1.7 \text{ m/s}^2$  is

- A) 1.7 km/s
- B) 2.89 km/s
- C)  $1.7 \sqrt{2}$  km/s
- D) 3.4 km/s



41) Total energy of a particle of mass 'm' executing SHM given by  $y = a \sin \omega t$  for any displacement is:

- A)  $m\omega^2 A^2$
- B)  $(1/2) m\omega^2 A^2$
- C)  $m\omega^2 A$
- D)  $(1/2) m\omega^2 A$

42) An electron revolves round a nucleus of charge  $Ze$ . 40.8 eV of energy is needed to excite an electron from  $n=1$  to  $n=2$  state. Find the value of  $Z$ .

- A) 2
- B) 4
- C) 6
- D) 8

43) Select the correct statement from the following:

- A) The magnetic dip is zero at the centre of the earth
- B) Magnetic dip decreases as we move away from the equator towards the magnetic pole
- C) Magnetic dip increases as we move away from the equator towards the magnetic pole
- D) Magnetic dip does not vary from place to place

44) A wire of Young's modulus  $Y$  is subjected to a stress  $S$ . The elastic potential energy per unit volume of the wire is given by

- A)  $SY/2$
- B)  $S^2/2Y$
- C)  $Y/2S$
- D)  $2Y/S^2$

45) Choose the correct statement in the following:

- (a) The magnetic field inside the solenoid is greater than that of outside
- (b) The magnetic field inside an ideal solenoid is not at all uniform
- (c) The magnetic field at the centre, inside an ideal solenoid is almost twice that at the ends
- (d) The magnetic field at the centre, inside an ideal solenoid is almost half of that at the ends

- A) only (a) is correct
- B) only (c) is correct
- C) both (a) & (c) are correct
- D) only (d) is correct

46) The wavelength of electromagnetic wave of frequency  $5 \times 10^{14}$  Hz is (in angstrom) is:

- A) 5000
- B) 3500
- C) 8200
- D) 6000

47) When the complete Young's double-slit experiment is immersed in water, the fringes

- A) remain unaltered
- B) become wider
- C) become narrower
- D) disappear

48) The refractive index 'n' and the polarizing angle ' $\theta_p$ ' of a medium are related as

- A)  $\theta_p = \sin^{-1}(n)$
- B)  $\theta_p = \tan^{-1}(n)$
- C)  $\theta_p = \sin^{-1}(1/n)$
- D)  $\theta_p = \tan^{-1}(1/n)$

49) A resistance of  $5 \Omega$  is connected in series with a capacitance of  $1 \text{ mF}$ . The combination is connected to AC source of angular frequency  $200 \text{ rads}^{-1}$ . Then

- A) the voltage leads the current by  $45^\circ$
- B) the current leads the voltage by  $45^\circ$
- C) the current leads the voltage by  $60^\circ$
- D) the voltage leads the current by  $60^\circ$

50) Two waves of the same kind and of the same amplitude  $A$  superpose at a point with a phase difference of  $\phi$  between them. Find the resultant amplitude (R).

- A)  $2A \sin(\phi/2)$
- B)  $2A \cos(\phi/2)$
- C)  $2A 2\phi$
- D)  $A \sqrt{2} \cos \phi$

51) In Young's double slit experiment, if one of the slits is covered with a microscope cover slip, then

- A) fringe pattern disappears
- B) the screen just gets illuminated
- C) in the fringe pattern, the brightness of the bright fringes will decrease and the dark fringes will become more dark
- D) bright fringes will be more bright and dark fringes will become more dark

52) The difference between the maximum and minimum values of resistance of a resistor with the color scheme green-green-red-silver is

- A)  $55 \Omega$
- B)  $1100 \Omega$
- C)  $44 \Omega$
- D)  $440 \Omega$

53) Energy of an electron in the lowest energy state of the hydrogen atom = 13.6 eV. Find the energy needed to remove an electron from the fourth orbit.

- A) 13.6 eV
- B) 0.85 eV
- C) 10.2 eV
- D) 6.8 eV



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54) For a given frequency, the inductive reactance of a coil at 100 H is  $25\Omega$ . For the same frequency, the inductance reactance at 200 H will be

- A)  $25\Omega$
- B)  $50\Omega$
- C)  $100\Omega$
- D) zero

55) The Electric field and magnetic field in electromagnetic waves are

- A) parallel to the wave's direction of travel as well as to each other
- B) parallel to the waves direction of travel and perpendicular to each other
- C) perpendicular to the wave's direction of travel and parallel to each other
- D) perpendicular to the wave's direction of travel and also to each other

56) Electrons behave like gas in J.J. Thompson experiment because they

- A) ionise the gas
- B) are effected by electric field
- C) are deflected by magnetic field
- D) diffracted by a crystal

57) An extrinsic semiconductor with electrons as majority carriers can be obtained by doping Ge or Si with

- A) bismuth
- B) boron
- C) indium
- D) gallium

58) When  ${}_{92}\text{U}^{235}$  undergoes fission, about 0.1% of the original mass is converted into energy. The energy released when 1 kg of  ${}_{92}\text{U}^{235}$  undergoes fission is

- A)  $9 \times 10^{11}$  J
- B)  $9 \times 10^{13}$  J
- C)  $9 \times 10^{15}$  J
- D)  $9 \times 10^{18}$  J

59) Which of the following is the indirect way of generating FM?

- A) Reactance FET modulator
- B) Varactor diode modulator
- C) Armstrong modulator
- D) Reactance bipolar transistor modulator

60) Amplitude modulation is the process of

- A) superimposing a high frequency signal on a low frequency carrier signal
- B) superimposing a low frequency signal on a high frequency carrier signal
- C) single-sideband communication
- D) amplitude shift and phase shift

