APSET - 2013

SUBJECT CODE	SUBJECT	PAPER
A-16-02	PHYSICAL SCIENCES	II

HALL TICKET NUMBER

1	1	1	6	0	1	4	9	0

QUESTION BOOKLET NUMBER

501507

OMR SHEET NUMBER

6	2	6	8	2	2

DURATION	MAXIMUM MARKS	NUMBER OF PAGES	NUMBER OF QUESTIONS
1 HOUR 15 MINUTES	100	16	50

This is to certify that, the entries made in the above portion are correctly written and verified.

Candidates Signature

Name and Signature of Invigilator

అభ్యర్థులకు సూచనలు

Instructions for the Candidates

1. Write your Hall Ticket Number in the space provided on the top of this page.
2. This paper consists of fifty multiple-choice type of questions.
3. At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested **to open the booklet and compulsorily examine it as below** :
   (i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker-seal and do not accept an open booklet.
   (ii) **Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.**
   (iii) After this verification is over, the Test Booklet Number should be entered in the OMR Sheet and the OMR Sheet Number should be entered on this Test Booklet.
4. Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.
   Example: (A) (B) ● (D)
   where (C) is the correct response.
5. Your responses to the items are to be indicated in the **OMR Answer Sheet** given to you. If you mark at any place other than in the circle in the Answer Sheet, it will not be evaluated.
6. Read instructions given inside carefully.
7. Rough Work is to be done in the end of this booklet.
8. If you write your name or put any mark on any part of the OMR Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, you will render yourself liable to disqualification.
9. The candidate must handover the OMR Answer Sheet to the invigilators at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. The candidate is allowed to take away the carbon copy of OMR Sheet and used Question paper booklet at the end of the examination.
10. Use only Blue/Black Ball point pen.
11. Use of any calculator or log table etc., is prohibited.
12. There is no negative marks for incorrect answers.

1. ఈ పుట పై బాగంలో ఇవ్వబడిన స్థలంలో మీ హాల్ టికెట్ నంబరు రాయండి.
2. ఈ ప్రశ్న పత్రము యాభై బహుళైచ్ఛిక ప్రశ్నలను కలిగి ఉంది.
3. పరీక్ష ప్రారంభమున ఈ ప్రశ్నపత్రము మీకు ఇవ్వబడుతుంది. మొదటి ఐదు నిమిషములలో **ఈ ప్రశ్నపత్రమును తెలిపి కింద తెలిపిన విధాలుగా ఈ విధంగా పరిశీలించండి.**
   (i) ఈ ప్రశ్న పత్రమును చూడడానికి కవర్ పేజి అంచున ఉన్న కాగితపు సీలును చింపండి. స్టిక్కర్-సీలులేని మరియు ఇతరంగా తెలిపి ఉన్న ప్రశ్నపత్రమును మీరు అంగీకరించవద్దు.
   (ii) కవర్ పేజి పై ముద్రించిన సమాచారం ప్రకారం ఈ ప్రశ్నపత్రములోని పేజిల నంబ్రను మరియు ప్రశ్నల నంబ్రను సరిచూసుకోండి. పేజిల నంబ్రను సంబందించి గాని లేదా నంబ్రను సంబంధించి ప్రశ్నల కలిపోవుట లేదా నిబద్దత కాకపోవుట లేదా ప్రశ్నల క్రమబద్ధతలో కలిపోవుట లేదా ఎటువంటి దోషమున్నా సరి అవ్వడానికి ఐదు నిమిషాలలో సరిగ్గా ఉన్న ప్రశ్నపత్రాన్ని పొందండి. తరువాత ప్రశ్నపత్రము మార్పబడదు లేదా అదనపు సమయం ఇవ్వబడదు.
   (iii) పై విధంగా సరిచూసుకొన్న తర్వాత ప్రశ్నపత్రం నంబ్రము OMR పత్రము పై ఆదేవరంగా OMR పత్రము నంబ్రము ఈ ప్రశ్నపత్రము పై నిర్దేశింతమైన స్థలంలో రాయవలెను.
4. ప్రతి ప్రశ్నకు నాలుగు ప్రత్యామ్నాయ ప్రతిస్పందనలు (A), (B), (C) మరియు (D) గా ఇవ్వబడతాయి. ప్రతిప్రశ్నకు సరైన ప్రతిస్పందనను ఎప్పటిని కింద తెలిపిన విధంగా OMR పత్రములో ప్రతి ప్రశ్న నంబ్రకు ఇవ్వబడిన నాలుగు వృత్తాల్లో సరైన ప్రతిస్పందనను సూచించే వృత్తాన్ని బాల్ పాయింట్ పెన్ తో కింద తెలిపిన విధంగా పూరించాలి.
   ఉదాహరణ : (A) (B) ● (D)
   (C) సరైన ప్రతిస్పందన అయితే
5. ప్రశ్నలకు ప్రతిస్పందనను ఈ ప్రశ్నపత్రముతో ఇవ్వబడిన OMR పత్రము పైన ఇవ్వబడిన వృత్తాల్లోనే పూరించి గుర్తించాలి. అలాకాక సమాధాన పత్రంపై వేరెక చోట గుర్తిస్తే మీ ప్రతిస్పందన మూల్యాంకనం చేయబడదు.
6. ప్రశ్న పత్రము లోపల ఇవ్విన మార్జినలను జాగ్రత్తగా చదవండి.
7. చిత్తుపనిని ప్రశ్నపత్రము చివర ఇవ్విన బోర్లస్థలములో చేయాలి.
8. OMR పత్రము పై నిర్దేశిత స్థలంలో సూచించబడిన వివరాలు తప్పించి ఇతర స్థలంలో మీ గుర్తింపును తెలిపే విధంగా మీ పేరు రాయడం గాని లేదా ఇతర వివరాలను పెట్టడం గాని చేసినచ్చునైతే మీ అనర్హతకు మీరే బాధ్యులవుతారు.
9. పరీక్ష పూర్తయిన తర్వాత మీ OMR పత్రాన్ని తప్పనిసరిగా పరీక్ష పర్యవేక్షకునికి ఇవ్వాలి. వాటిని పరీక్షగది బయటకు తీసుకవెళ్ళకూడదు. పరీక్ష పూర్తయిన తరువాత అభ్యర్థులు పరీక్ష పత్రాన్ని OMR పత్రము యొక్క, కార్బన్ కాపీని తీసుకవెళ్లవచ్చు.
10. నీలి/నల్ల రంగు బాల్ పాయింట్ పెన్ మాత్రమే ఉపయోగించాలి.
11. లాగరిథమ్ టేబుల్స్, కాల్కులేటర్లను, ఎలక్ట్రానిక్ పరికరాలు మొదలగునవి వర్జ్యంలో ఉపయోగించడం నిషేధం.
12. తప్పు సమాధానాలకు మార్కులు తగ్గించబడవు.

PHYSICAL SCIENCES
Paper – II

1. A force f acting on a particle is proportional to velocity gradient. The law is given by $f = \mu \dfrac{du}{dx}$ where u is velocity of the particle, x is distance travelled and μ is the proportionality constant. The dimensions of μ are

   (A) $ML^{-1}T$

   (B) MLT^{-1}

   (C) $M^{-1}L^{-1}T$

   (D) $ML^{-1}T^{-1}$

2. If $r = xi + yj + zk$ and a is a constant vector,

Column I	Column II
I. $\nabla \times (a \times r)$	1. $-2a$
II. $(a \times \nabla) \times r$	2. $2(r \times a)$
III. $a \times (\nabla \times r)$	3. $2a$
IV. $\nabla \times ((r.r)a)$	4. 0

   Choose correct matching among A, B, C, D for the row I, II, III, IV given below

	I	II	III	IV
(A)	3	4	2	1
(B)	3	1	4	2
(C)	2	3	4	1
(D)	4	3	1	2

3. If det $A \neq 0$, which of the following is NOT true ?

   (A) A is singular

   (B) Ax = b will have unique solution

   (C) A has non zero eigen values

   (D) All columns of A are independent

4. If a square matrix A is singular, then which of the following is true ?

   (A) Modulus of eigen values = 1

   (B) Coefficient of λ in the characteristic polynomial = 0

   (C) Constant term of characteristic polynomial = 0

   (D) Sum of the eigen values is zero.

5. If $y_1, y_2, \ldots, y_n$ are solutions of nth order differential equation and sum of the solutions i.e $\sum y_i$ is also a solution of the differential equations, then the differential equation is

   (A) linear and homogeneous

   (B) linear and non-homogeneous

   (C) nonlinear and homogeneous

   (D) homogeneous

6. **Assertion (A) :** If X is a normal random variable, then mean is zero.

   Reason (R) : Square of the standard deviation is equal to second moment about mean.

   (A) Both A and R are true

   (B) A is false but R is true

   (C) A is true but R is false

   (D) A is true but R is not correct explanation

7. The probability that A passes a test is 1/5, the probability that B passes the same test is 2/3. The probability that only one of them passes is

   (A) 3/5

   (B) 2/15

   (C) 13/15

   (D) 4/15

8. If w = f(z) is analytic, then

   (A) $\dfrac{\partial w}{\partial z} = \dfrac{\partial w}{\partial \overline{z}}$

   (B) $\dfrac{\partial w}{\partial z} = 0$

   (C) $\dfrac{\partial w}{\partial \overline{z}} = 0$

   (D) $\dfrac{\partial w}{\partial z} = i \dfrac{\partial w}{\partial \overline{z}}$

9. $\int_0^1 x J_n(\alpha x) J_n(\beta x)\,dx = 0$ if

   (A) $\alpha \neq \beta$

   (B) n is integer only

   (C) α, β are integers only

   (D) $0 < \alpha, \beta < 1$

10. Newton's laws are not valid if

    (A) Bodies are in contact with each other

    (B) Observers are moving at constant velocity

    (C) Reference frame is at rest or fixed

    (D) Reference frame is rotating

11. In phase space diagram of a dynamical system, a point represents, if n = df

    (A) n, momentum coordinates p_i

    (B) n, generalise coordinates q_i

    (C) 2n momentum and generalise coordinates (p_i, q_i)

    (D) 2n space and rotation coordinates

12. In phase space, _____ is invariant under canonical transformations.

    (A) momentum

    (B) energy

    (C) angular velocity

    (D) volume

13. A particle is moving on elliptical path under inverse square law of force of the form $f = -k/r^2$. Which of the following statements are true ? The eccentricity of the orbit is

    I. Function of total energy

    II. Independent of total energy

    III. Function of angular momentum

    IV. Independent of angular momentum

    (A) I, III are true

    (B) I, II are true

    (C) II, IV are true

    (D) I, IV are true

14. Rutherford's differential scattering cross-section

    (A) has the dimensions of area

    (B) has the dimensions of solid angles

    (C) is proportional to the kinetic energy of the incident particle

    (D) inversely proportional to $\cos\phi$, ϕ is the scattering angle

15. Choose the correct statement.

    I. In δ variation, time and space coordinates vary

    II. In Δ variation, time and space coordinates vary

    III. δ variation is independent of time

    IV. Δ variation is independent of time

    (A) I, IV are true

    (B) II, III are true

    (C) I, II are true

    (D) III, IV are true

16. Which of the following is NOT a Kepler's law ?

    (A) All planets move in plane curves

    (B) The radius vector of the planet sweeps equal areas in equal intervals of times

    (C) Cube of the time period of the planet is proportional to square of the area traced

    (D) Angular momentum of the planet is always constant

17. For a cyclic ordinate of the Lagrangian of the system, the corresponding

    (A) momentum is constant

    (B) energy is constant

    (C) force is constant

    (D) torque is constant

18. In the laboratory a particle A has velocity v, another particle B has velocity –v, the velocity of A relative to B is

    (A) 2v

    (B) $2v/(1 + v^2/c^2)$

    (C) $2v/(1 - v^2/c^2)$

    (D) $2v/\sqrt{(1 - v^2/c^2)}$

19. Div $\bar{D}$ has a value wherever

    i. Electric charge is present

    ii. Magnetic dipole is present

    (A) i is correct and ii is wrong

    (B) ii is correct and i is wrong

    (C) Both i and ii are correct

    (D) Both i and ii are wrong

20. In a homogeneous and isotropic media $\bar{D}$ and $\bar{E}$ are

    (A) In the same direction

    (B) In the opposite direction

    (C) Perpendicular to each other

    (D) May be in different orientation

21. The intrinsic resistance of empty space is given by

    (A) $\sqrt{\varepsilon_0/\mu_0}$

    (B) $\sqrt{\mu_0/\varepsilon_0}$

    (C) ε_0/μ_0

    (D) $(\varepsilon_0/\mu_0)^2$

22. Choose the correct statement.

   i. In a lossless nondispersive media the group velocity is always greater than phase velocity.

   ii. In a dispersive medium, the phase velocity is a function of frequency and hence of the free space wavelength.

(A) i is correct and ii is wrong

(B) ii is correct and i is wrong

(C) Both i and ii are correct

(D) Both i and ii are wrong

23. Poisson's equation in charge free space reduces to

(A) Laplace's equation

(B) Gauss's law for dielectrics

(C) Kirchoff's law

(D) Lorentz's force equation

24. Three point charges $30 \mu C$, $130 \mu C$ and $-80 \mu C$ are enclosed by a surface. The net flux across the surface is

(A) $-50 \mu C$

(B) $60 \mu C$

(C) $80 \mu C$

(D) $-80 \mu C$

25. Choose the correct statement.

   i. The divergence of a curl for any vector field is the zero scalar.

   ii. The curl of a gradient for any scalar function of position is the zero vector.

(A) i is correct and ii is wrong

(B) ii is correct and i is wrong

(C) Both i and ii are correct

(D) Both i and ii are wrong

26. Assertion (A): Bar magnet freely dropped through a long copper conduit held vertically moves with terminal velocity.

Reason (R): This is a consequence of Kirchoff's law.

(A) A and R are true and R is the correct explanation

(B) A and R are true and R is not the correct explanation

(C) A is true but R is not the correct explanation

(D) Both A and R are false.

27. The electric field given by E(z,t) = 10 sin $(\omega t + \beta z)\bar{a}_x + 10\cos(\omega t + \beta z)\bar{a}_y$ is

    (A) Plane polarized

    (B) Elliptically polarized

    (C) Circularly polarized

    (D) Unpolarized

28. Match the following :

Column I	Column II
I. Bohr's radius	1) 1/137
II. Fine structure constant	2) 13.6 eV
III. Compton wavelength	3) 0.53 A°
IV. KE of electron in ground state of H_2 atom	4) 0.0242 A°

    Choose correct matching among A, B, C, D for the row I, II, III, IV given below :

	I	II	III	IV
(A)	3	2	4	1
(B)	3	1	4	2
(C)	1	2	3	4
(D)	2	4	1	3

29. Choose the wrong statement.

    (A) Wave associated with material particle is a superposition of infinite number of plane waves with slightly differing k values

    (B) Eventhough the constituent waves can move with different speeds, the wave packet moves with particle velocity and hence never leaves the particle

    (C) The phase velocity can be greater than speed of light

    (D) Wavefunction gives the chance of locating the particle at a given instant of time and at a given location in space

30. The ratio of de-Broglie wavelength of an electron to that of proton when both of them move with the same kinetic energy is

    (A) 1836

    (B) 1/1836

    (C) $\sqrt{1836}$

    (D) $1/\sqrt{1836}$

31. The zero point energy of a linear harmonic oscillator is

(A) $h\nu$

(B) $(n + \frac{1}{2})h\nu$

(C) $(1/2)h\nu$

(D) $(1/2)h\omega$

32. Choose the correct statement.

  i. The expectation value of an observable whose operator does not depend on time explicitly is a constant with zero uncertainty.

  ii. Eigen functions of a Hermitian operator belonging to distinct eigen values are orthogonal.

(A) i is correct and ii is wrong

(B) ii is correct and i is wrong

(C) Both i and ii are correct

(D) Both i and ii are wrong

33. Entropy of a thermodynamics system does not change when the system is used for

(A) Conductance of heat from a hot reservoir to a cold reservoir

(B) Conversion of heat into work adiabatically

(C) Conversion of heat into internal energy isochorically

(D) Conversion of work into heat isothermally

34. Based on Maxwell thermodynamic relations and applying to specific heat equation, then

(A) $C_p - C_v = T$

(B) $C_p - C_v = \left(\dfrac{\partial P}{\partial T}\right)_V$

(C) $C_p - C_v = RT$

(D) $C_p - C_v = T\left(\dfrac{\partial P}{\partial T}\right)_V \left(\dfrac{\partial V}{\partial T}\right)_P$

Read the passage and answer the questions 35, 36 and 37 given below :

Every system(solid, liquid or gas) possesses a certain amount of energy. This energy is called internal energy and is usually denoted by the symbol U. The internal energy of a solid, liquid or gas consists of two parts (i) kinetic energy due to the motion (translational, rotational, vibrational) of the molecules (ii) potential energy due to the configuration (separation) of the molecules. The internal energy of a homogeneous system depends on its thermodynamic state i.e. on its thermodynamic coordinates P, V and T.

Each definite state of the system possess a definite quantity of internal energy. A change in the internal energy can occur only if a transfer of energy between the system and surroundings is permitted. This can take place if (i) some work is performed on or by the system and (ii) some heat is absorbed or given out by the system.

35. In an isothermal process

    (A) the temperature of the gas is not constant

    (B) the gas does not take any heat from the surroundings

    (C) the internal energy of the gas remains constant

    (D) the pressure and volume of gas remain constant

36. In an adiabatic process

    (A) the gas cannot take any heat from or give any heat to the surroundings

    (B) the temperature of the gas remains constant

    (C) the internal energy of the gas does not change

    (D) no work is done either on the gas or by the gas

37. In a given process on an ideal gas $dw = 0$ and $dQ > 0$ then

    (A) the temperature of the gas will decrease

    (B) the temperature of the gas remains constant

    (C) the internal energy of the gas will decrease

    (D) the internal energy of the gas will increase

38. In case of two thermodynamic systems having molecules with chemical potentials μ_1 with N_1 particles, μ_2 with N_2 particles where $\mu_1 > \mu_2$, if they are in thermal equilibrium initially, $(\theta_1 \approx \theta_2 \approx \theta)$ the thermodynamic condition of entropy change gives condition that

    (A) $-\dfrac{1}{\theta}(\mu_1 - \mu_2)dN_1 > 0$

    (B) $(\mu_1 - \mu_2)dN_1 = 0$

    (C) $(\mu_1 - \mu_2)dN_1 > 0$

    (D) $(\mu_1 - \mu_2)dN_2 < 0$

39. Choose the correct statement. Statistical mechanics deals about

(A) not a particular individual movement of particles in a system

(B) it will not give information about overall behaviour of a system of many particles related to the properties of the particles themselves

(C) it helps how to find life history of one of the particles in a system

(D) it is not able to tell us the probability that the particle has a certain amount of energy at a certain moment

40. Choose the wrong statement. According to Fermi - Dirac statistics, Fermions

(A) have odd half integer spins

(B) they obey exclusion principle

(C) they have symmetric wave function

(D) only one Fermion can exist in a particular quantum state of a system

41. If g_m and r_d are the transconductance and drain resistance of a JFET respectively, the greatest voltage amplification that can be possible with this device can be

(A) g_m

(B) r_d

(C) $g_m r_d$

(D) g_m / r_d

42. Which one of the following is correct ?

    i. In a tunnel diode, current can be tripple valued function of voltage

    ii. Tunnel diode possess negative resistance region

    iii. Tunnel diodes are fabricated with very lightly doped PN junction

(A) i & ii only are correct

(B) ii & iii only are correct

(C) iii & i only are correct

(D) All are correct

43. The sloping up of BJT characteristics in the active region of CE configuration is due to

(A) Thermal Runway

(B) Punch through

(C) Early effect

(D) Miller effect

44. Which one of the following is correct?
Solar cells are used as source of power in earth satellite because they have

i) high efficiencies

ii) unlimited life

iii) high power capacity per weight

(A) i &ii only are correct

(B) ii & iii only are correct

(C) iii & i only are correct

(D) All are correct

45. If α_F and α_R are the forward and inverted mode current gains of BJT, then

(A) $\alpha_F = \alpha_R$

(B) $\alpha_F < \alpha_R$

(C) $\alpha_F > \alpha_R$

(D) $\alpha_F \gg \alpha_R$

46. Which one of the following is correct ?

LED i)   is usually made from silicon

ii)   emits light when forwarded biased

iii)   do not require warm-up time

(A) i &ii only are correct

(B) ii & iii only are correct

(C) iii & i only are correct

(D) None are correct

47. An ideal Op Amp is an ideal

(A) voltage controlled current source

(B) voltage controlled voltage source

(C) current controlled current source

(D) current controlled voltage source

48. Which one of the following is correct? Tuned amplifiers are

   i. wide band amplifiers

   ii. used in Radio Transmitters and Receivers

   iii. performance is determined by Q of the circuit

(A) i & ii only are correct

(B) ii & iii only are correct

(C) iii & i only are correct

(D) All are correct

49. In Toggle mode, JK flip flop has

(A) J=0, K=0

(B) J=0, K=1

(C) J=1, K=0

(D) J=1, K=1

50. While .... is the fastest unsaturated logic gate, ... has excellent noise immunity.

(A) ECL, TTL

(B) TTL, ECL

(C) ECL, HTL

(D) RTL, DTL