(SUBJECTIVE PART)
68/68 Marks Challenge

SECTION-I

SHORT QUESTIONS (SQs)

1. Give the draw backs to use the period of simple pendulum as a time standard.
2. Calculate the distance covered by the light in free space in one year
3. What are supplementary units? Define only one unit.
4. Differentiate between base units and derived units.
5. Define light year and what are the unit and dimensions of light year?
6. Show that 1 rad = $67.3°$
7. How many micro seconds in one year?
8. Why do we find it useful to have two units for the amount of substance, the kilogram and the mole?
9. Define random error and systematic error?
10. The period of a pendulum cannot be used as a time standard why?
11. Check the correctness of the relation $v = \left[\frac{F \times l}{m}\right]^{1/2}$ where "v" is the speed transverse wave on a stretched spring of tension F, length "I" and mass "m".
12. Is a zero significant or not? Explain.
13. What is the difference between precision and accuracy?
14. The period of simple pendulum is measured by a stop watch what type of errors are possible in the time period?
15. How you can find uncertainty in a timing experiment?
16. What are the dimensions and unit of gravitational constant G in the formula $F = \frac{GmM}{r^2}$?
17. Show that $S = v_i t + \frac{1}{2} at^2$ is dimensionally correct.
18. Write down the two uses of dimension analysis.   **2 Times**
19. Check the correctness of the relation $v = \sqrt{\frac{F \times l}{m}}$ dimensionally?
20. Write the dimension of pressure and density.
21. Show that the famous "Einstein Equation" E=mc is dimensionally consistent. Calculate equivalence energy of one
22. Decide which is correct $f = v\lambda$ or $f = \frac{v}{\lambda}$
23. Define the terms i) Null vector ii) Subtraction of vector.
24. What is the unit vector in the direction of vector $\vec{A} = 2\hat{i} - \hat{j} + 2\hat{k}$?
25. Define component of a vector? What are rectangular components?
26. If all the components of the vectors, $\vec{A_1}$ and $\vec{A_2}$ were reversed, how would this alter $\vec{A_1} \times \vec{A_2}$?
27. Define: (1) Unit vector (ii) Position vector ii) components of a vector.
28. If one of the rectangular components of a vector is not zero, can its magnitude be zero? Explain.
29. Can the magnitude of a vector have a negative value?
30. If $\vec{A} + \vec{B} = 0$, what can you say about the components of the two vectors?
31. Under what circumstances would a vector have components that are equal in magnitude?
32. Is it possible to add a vector quantity to a scalar quantity?
33. Can you add zero to a null vector?
34. Write down the five steps for addition of by rectangular component method.
35. Name three conditions that could make $\vec{A} \cdot \vec{B} = 0$:
36. Find the angle between $\vec{A} = 2\hat{i} - 2\hat{j}$ and $\vec{B} = 2\hat{i} + 2\hat{j}$

37. What is the vector product, give its two characteristics?
38. State first and second conditions of equilibrium in terms of linear and angular acceleration.
39. A picture is suspended from a wall by two strings. Show by diagram the configuration of the strings for which the tension in strings will be minimum.
40. What is the difference between uniform and variable velocity? Give S.I. units of velocity and acceleration.
41. Can the velocity of an object reverse the direction when acceleration is constant? If so, give an example.
42. How acceleration and distance can be calculated from velocity time graph?
43. Explain the circumstances in which the velocity 'v' and acceleration 'a' of a car are:
44. (a)   Parallel   (b) Perpendicular to one another   (c) Anti-parallel
45. State Newton's Second and Third Law of Motion.
46. State Newton's second law of motion and define the unit of force.
47. What will be the velocity of the particle if its momentum and kinetic energy are equal in magnitudes?
48. Is law of conservation of momentum is valid in an Elastic and Inelastic Collision?
49. Find the change in change in momentum for an object for a given time and state law of motion in terms of momentum.
50. Show that rate of change in momentum for an object is equal to applied force.
51. Define impulse and show how it is related to linear momentum?
52. Find the velocities of two elastically colliding 35 bodies when $m_1 = m_2$ after collision.
53. Differentiate between elastic and inelastic collision. Explain how would a bouncing ball behave in each case?
54. Briefly describe the force due to water flow.
55. When rocket re-enters the atmosphere, its nose becomes very hot, why?
56. What is ballistic flight? Explain.
57. Is the range of projectile same for both angles of projectile of 30° and 60°? If your answer is yes then prove it?
58. Water is projected from two rubber pipes at the same speed v from one at 30° and from other at 60°. Why are the ranges equal? What is trajectory? Explain briefly.
59. Explain what is meant by projectile motion. Derive expression for:
    a.   The time of flight   b. The range of projectile
60. Show that range of projectile is maximum when the projectile is thrown at an angle of 45° with horizontal.
61. Define range of projectile. In which situations its value is maximum and minimum.
62. At what point or points in the path does a projectile have its minimum speed, its maximum speed?
63. Why fog droplets appear to be suspended in air?
64. Explain the difference between laminar flow and turbulent flow.
65. State Bernoulli's relation for a liquid in motion and describe some of its applications.
66. A person is standing near a fast moving train. Is there any danger that he will fall towards it?
67. Explain, how the swing is produced in a fast moving cricket ball?
68. Explain viscosity. What do you understand by the term viscosity? Explain.
69. Explain the working of a carburetor of a motor car using Bernoulli's principle.
70. Write values of systolic and diastolic blood pressure for a normal healthy man.
71. Derive venturi relation.
72. State Torricelli's theorem and write its relation.
73. Write values of systolic and diastolic blood pressure for a normal healthy man
74. How can you measure blood pressure?
75. Define viscosity and drag force.
76. What is meant when we say fluid is non-viscous and incompressible?
77. State Stoke's law. Give its mathematical form.

SECTION-II

SHORT QUESTIONS (SQs)

1. Calculate the work done in kilojoules in lifting a mass of 10 kg (at a steady velocity) through a vertical height of 10m.
2. In which case is more work done? When a 50kg bag of books is lifted through 50cm, or when a 50kg crate is pushed through 2m across the floor with a force of 50N?
3. An object has 1J of potential energy. Explain what does it mean?
4. What sort of energy is in the following: i)Compressed spring ii)Water in a high dam iii)A moving car
5. A girl drops a cup from a certain height, which breaks into pieces. What energy changes are involved?

6.   When a rocket re-enters the atmosphere, its nose cone becomes very hot. Where does this heat energy come from?
7.   State the direction of the following vectors in simple situations, angular momentum and angular velocity.
8.   Why mud flies off the tyre of a moving bicycle, in what direction does it fly?
9.   Why does a diver change his body positions before and after diving in the pool?
10. Name two characteristics of simple harmonic motion.
11. Does frequency depends on amplitude for harmonic oscillators?
12. Can we realize an ideal simple pendulum?
13. Does the acceleration of a simple harmonic oscillator remain constant during its motion? Is the acceleration ever zero? Explain.
14. What is meant by phase angle? Does it define angle between maximum displacement and the driving force?
15. Under what conditions does the addition of two simple harmonic motions produce a resultant, which is also simple harmonic?
16. Describe some common phenomena in which resonance plays an important role.
17. What features do longitudinal waves have in common with transverse waves?
18. Is it possible for two identical waves travelling in the same direction along a string to give rise to a stationary wave?
19. Why does sound travel faster in solids than in gases?
20. How are beats useful in tuning musical instruments?
21. Explain why sound travels faster in warm air than in cold air?
22. A wave is produced along a stretched string but some of its particles permanently show zero displacement. What type of wave is it?
23. An object has one joule potential energy. What does it mean? Explain.
24. Under what conditions work done will be positive and negative.
25. Define kilowatt hour. Show that $1kWh = 3.6 \times 10^6 J$.
26. Differentiate between conservative and non-conservative forces. Give examples.
27. Define work energy principle. Also write down its equations.
28. A stone is dropped from a height of 10m vertically down ward. What energy changes are involved?
29. State law of conservation of energy.
30. Write down two sources of energy which are renewable.
31. How energy can be obtained from waste products?
32.   A 70kg man runs up flight of stairs in 9.8sec. The vertical height of the stairs in 5m. Calculate his power in KW.
33. What is Salter's duck? Explain it.
34. What is the difference between tangential velocity and angular velocity?
35. Define positive and negative angular acceleration. Give examples for each.
36. What is difference between angular acceleration and centripetal acceleration?
37. Prove that $v = r\omega$.
38. Banked tracks are needed for turns on highway. Why?
39. Define centripetal force and centripetal acceleration.
40. Define moment of inertia, how it is related to torque.
41. What will be the effect on moment of inertia of a cylinder of about its axis if its diameter is doubled?
42. Show that the angular momentum L0=m v r.
43. State the direction of the follow's vectors in simple situations, angular momentum and angular velocity.
44. Define angular momentum and give its dimensions.
45. What is meant by angular momentum? State law of conservation of angular momentum.
46. Why does the coasting rotating system slow down as some material object is added to the system during rotations?
47. Why is the axis of rotation of Earth remains fixed in one direction with respect to the universe around it?
48. A disc and hoop start moving down from the top of inclined plane at the same time. Which one will be the moving faster on reaching the ground?
49. A disc is rolling down on an inclined plane. Find the rotation for the speed of disc at its bottom.
50. State the practical use of rotational K.E by fly wheels
51. What are the differences between real and apparent weight?
52. A lift is ascending with the acceleration "a". Derives the expression for apparent weight. Time body of mass "m" in it.
53. How artificial gravity is created in an artificial satellite?
54. Write down at least four uses of Geostationary satellites.
55. What is meant by INTELSAT? Explain.
56. Find total kinetic energy of rolling sphere of mass "m" and radius "r" on horizontal smooth surface.
57. What is difference between spin angular momentum and orbital angular momentum.
58. Derive the relation between radian, degree and revolution.
59. Prove that $S = r\theta$.
60. A disc and a hoop start moving down from the top of an inclined plane at the same time, which one will be moving faster on reaching the bottom?
61. Show that $a = r\alpha$.
62. Define simple harmonic motion. Express it mathematically.

63. Define the terms used in SHM: i) Time period   ii) Amplitude
64. What happens to the period of a simple pendulum of its length is doubled? What happens if the suspended mass is doubled
65. State hook's law writes it in mathematical form.
66. What is the effect of amplitude on frequency and period of simple pendulum?
67. What happens to the period of the simple pendulum if the length is halved and mass of bob is doubled?
68. In an oscillating mass spring system if mass is doubled, how its time period will change?
69. Describe the condition under which a vibrating body resonates with other body
70. The amplitude of simple pendulum should be small, why? Explain
71. Define restoring force and simple harmonic motion.
72. What is difference between longitudinal and transverse wave?
73. Define mechanical waves and electromagnetic waves. Given examples of each.
74. Explain why sound travel faster in warm air than in cold air?
75. What is the effect of density on speed of sound? Explain briefly.
76. What is path difference? What should be the path difference for constructive and destructive interference?
77. What is the difference between interference and beats?
78. Explain the term red shift and blue shift in Doppler's effect.
79. What is the affect on phase of a wave when it is reflected from a boundary?
80. What do you mean by "Sonar Technique"?
81. How can Doppler effect be used to monitor blood flow through major arteries?
82. How Doppler's effect is applied to a radar system?
83. Taking an example of periodic wave, prove that $v = f\lambda$.

SECTION-III

SHORT QUESTIONS (SQs)

1. Under what conditions two or more sources of light behave as coherent sources?
2. Can visible light produce interference fringes? Explain.
3. Explain whether the Young's experiment is an experiment for studying interference or diffraction effects of light.
4. An oil film spreading over a wet footpath shows colors. Explain how does it happen?
5. Could you obtain Newton's rings with transmitted light? If yes, would the pattern be different from that obtained with reflected light?
6. How would you manage to get more orders of spectra using a diffraction grating?
7. Why the polaroid sunglasses are better than ordinary sunglasses?
8. How would you distinguish between un-polarized and plane-polarized lights?
9. Why would it be advantageous to use blue light with a compound microscope?
10. If a person was looking through a telescope at the full moon, how would the appearance of the moon be changed by covering half of the objective lens?
11. How the light signal is transmitted through the optical fibre?
12. How the power is lost in optical fibre through dispersion?
13. Why is the average velocity of the molecules in a gas zero but the average of the square of velocities is not zero?
14. Why does the pressure of a gas in a car tyre increase when it is driven through some distance?
15. Specific heat of a gas at constant pressure is greater than specific heat at constant volume. Why?
16. Is it possible to convert internal energy into mechanical energy? Explain with an example.
17. Is it possible to construct a heat engine that will not expel heat into the atmosphere?
18. Can the mechanical energy be converted completely into heat energy? If so give an example.
19. Does entropy of a system increase or decrease due to friction?
20. Define wave front and a ray of light.
21. Define wave-front and diffraction of light.
22. What is meant by wave front? Give its types.
23. State Huygen's principle?
24. Write the conditions for detectable interference.
25. Prove that $\Delta y = \frac{\lambda L}{d}$
26. What is Michelson's interferometer? Also write its working principle.
27. Define coherent source of light. Give an example.
28. On what factor, the distance between adjacent bright fringes in Young's double slits experiment depends?
29. If white light is incident on a film of irregular thickness at all possible angles, when will be the pattern of interference fringes? Explain your answer.

30. Give two applications of Michelson's interferometer.
31. Write down selective absorption method to obtain plane polarized light from ordinary light.
32. What are Newton's rings?
33. In Newton's ring, why are the fringes circular?
34. What is contribution of Michelson to measure the length of standard meter using interferometer?
35. What is the difference between interference and diffraction?
36. What is meant by the diffraction of light?
37. A typical diffraction grating has 5000 lines per centimeter. What will be the grating element of this diffraction grating in meters?
38. What is diffraction grating and grating element?
39. Write down two methods by which we can obtain plane-polarized beam of light from un-polarized light.
40. Why diffraction grating cannot be used for X-rays diffraction?
41. Write the names of any four processes to obtain plane polarized beam of light from polarized light.
42. What is the usual way to obtain plane wave front a point source?
43. Write two uses of X-rays diffraction by crystal.
44. Why X-rays cannot be diffracted by ordinary glass grating?
45. Differentiate between Constructive and Destructive Interference.
46. What is meant by polarized light? Explain.
47. What is fringe spacing? And how the fringe spacing is increased?
48. Explain the difference between angular magnification and resolving power of an optical instrument.
49. What is difference between magnifying power and resolving power of optical instrument?
50. Define Snell's Law and write its mathematical form.
51. What us optical resolution and resolving power?
52. What is simple microscope? Write down the equation for its magnifying power.
53. Describe with the help of ray diagrams, how a single-biconvex lens can be used as a magnifying glass?
54. Sketch the ray diagram of a compound microscope.
55. Write down the main parts of spectrometer and two used of spectrometer.
56. What is Collimator? Why it is named so?
57. Write the advantages use of light as transmission carrier wave over radio wave carriers.
58. Draw sketch showing the different light paths through a single mode and a multi-mode fibre.
59. Define critical angle and total internal reflection.
60. What is difference between multimode step index and multimode graded index fibre?
61. Write down the three major components on which a fibre otpic communication system consists.
62. An astronomical telescope of long focal length and large aperture is considered to be a good telescope. Why?
63. Define Refractive index of a medium. Write its two mathematical forms.
64. Write down the main postulates of kinetic theory of gases.
65. Can the mechanical energy be converted completely into heat energy? If so give an example.
66. Derive Boyle's law from the expression for pressure of gas.
67. Define Charles law how it is derived from kinetic theory of gases.
68. Why absolute value of internal energy cannot be measured?
69. Prove that $W = P\Delta V$.
70. Is it possible to construct a heat engine of hundred percentage efficiency? Explain.
71. What is reversible and irreversible process?
72. What is adiabatic process? Under what conditions these processes occur?
73. Under what circumstances the efficiency of a carnot engine will be 100%? Is it possible?
74. State second law of thermodynamics.
75. A real heat engine is less efficient than carnot engine. Why?
76. State Carnot Theorem.
77. What is entropy? Give its mathematical relation.
78. State second law of thermodynamics in terms of entropy.
79. Define thermodynamics scale of temperature.
80. Why adiabate is steeper than isotherm?
81. Explain bicycle pump as an example of first law of thermodynamics.
82. Define molar specific heat of a gas at constant volume and molar specific heat at constant pressure.
83. Solid line represents adiabatic and dotted line isothermal process. In which process more work is done?
84. Can the efficiency of a Carnot Engine 100%? Explain.

LONG QUESTIONS