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Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, February 2018
First Degree Programme under CBCSS
COMPLEMENTARY COURSE I FOR CHEMISTRY AND POLYMER CHEMISTRY
PY 1131.2 – Rotational Dynamics and Properties of Matter
(2013 Admission Onwards)

Time : 3 Hours Max. Marks : 80

All Saints' College Trivandrum

SECTION – A

Answer **all** questions in **one** or **two** sentences. **Each** question carries **one** mark.

1. What is torque ?
2. Define moment of inertia.
3. Define law of conservation of angular momentum.
4. Write the equation for a damped harmonic oscillator.
5. Define frequency of a wave.
6. Define stress and strain.
7. Give the relation between Young's Modulus, Bulk Modulus and Poisson ratio.
8. Define viscosity.
9. What is meant by capillary action ?
10. Define torsional rigidity. **(10×1=10 Marks)**

SECTION – B

Answer **any eight** questions, **not** exceeding a paragraph. **Each** question carries **two** marks.

11. State and explain perpendicular axes theorem.
12. What is centripetal force ? Write and explain its equation.
13. Derive the equation for total energy in a simple harmonic wave.

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14. Simple harmonic motion is equivalent to circular motion. Justify.
15. Obtain the equation for period of a simple pendulum.
16. Explain the term rigidity modulus. What is its SI unit ?
17. What is more elastic, steel or rubber ? Why ?
18. Explain the variation of viscosity with temperature for fluids.
19. Obtain the moment of inertia of a uniform circular ring about an axis passing through its centre.
20. What is a cantilever ? What is its use ?
21. Obtain the expression for the kinetic energy of a rotating body.
22. Water wets glass, but mercury does not, why ? Also explain angle of contact.

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SECTION – C

Answer **any six** questions. **Each** question carries **four** marks.

23. The radius of gyration of a uniform disc about a line perpendicular to the disc is equal to its radius. Find the distance of the line from the centre.
24. The rotor of a motor has a moment of inertia 15 kgm^2. Calculate the torque required to increase its speed of rotation from 320 rpm to 600 rpm in 4 seconds.
25. A solid cylinder of mass 20 kg rotates about its axis with angular speed of 100 s^{-1}, the radius of the cylinder is 0.25 m. What is the KE associated with the rotation of the cylinder ?
26. Obtain the values of (a) frequency, (b) time period, (c) propagation constant and (d) angular frequency for light waves of wavelength 500 nm travelling in free space.
27. What stress would cause a wire to increase in length by 0.1%, if the Young's Modulus of the wire is 12×10^{10} Nm^{-2} ? Calculate the force required, if the diameter of the wire is 0.56 mm.
28. What is the pressure inside an air bubble of radius 3.6 mm at a depth of 40 m in a lake ? The surface tension of water is 0.72 Nm^{-2}.
29. An oil drop of density 800 g/m^3 and radius, 0.1 mm falls through air with a terminal velocity 0.968 m/s. Neglecting up thrust of air, calculate the coefficient of viscosity of air.

30. The total energy of a simple harmonic oscillator is 8 J. What will be its energy if its amplitude is doubled keeping other quantities the same.

31. A simple pendulum is set up in a lift. When the lift is moving up with an acceleration 8.2 m/s^2, the period is $\pi/3$ seconds. What will be the period when moves down with an acceleration 1.8 m/s^2 ? **(6×4=24 Marks)**

SECTION – D

Answer **any two** questions. **Each** question carries **fifteen** marks.

32. What is a fly wheel ? Derive an expression for finding the moment of inertia and rigidity modulus of a fly wheel.

33. Derive the expression for acceleration due to gravity using a compound pendulum.

34. Derive the equation for energy density of a plane progressive wave and show that it is completely independent of space and time. Also write the expression for intensity of a wave.

35. Define surface tension. Derive an expression for capillary rise. **(2×15=30 Marks)**

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