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Reg. No..............................

Name..................................

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, NOVEMBER 2014

First Semester

Complementary Course—Physics

PROPERTIES OF MATTER, MECHANICS AND FOURIER ANALYSIS

(For Mathematics Model I and Statistics)

[2013 Admission onwards]

Time : Three Hours

Maximum : 60 Marks

Candidates can use clark's tables and scientific non-programmable calculators.

Part A (Very Short Answer Questions)

Answer all questions briefly.
Each question carries 1 mark.

1. Define Poisson's ratio ? Explain.

2. Define Yield point and breaking stress.

3. Which is more elastic (i) rubber or steel ; (iii) air or water ?

4. A bicycle wheel has a special design in that the rim is supported by spokes. What would happen if the tyre is mounted on a solid rim ?

5. Explain the significance of static torsion.

6. What is resonance ? Write its practical applications.

7. Explain parallel axes theorem.

8. Write Dirichlet's conditions for Fourier series.

$(8 \times 1 = 8)$

Part B (Brief Answer Questions)

Answer any six questions.
Each question carries 2 marks.

9. When an object is stretched, its transverse dimension decreases. What happens to its volume ? Explain.

10. Assume that the bulk modulus of aluminium is 7.5×10^{10} N/m². How much the pressure must be increased if the volume of a block of aluminium is decreased by 1% ?

11. Why are the curved tracks generally banked ?

12. If one end of a bar is fixed and a load is applied to the other end, calculate the depression at the free end ?

Turn over

13. Explain how to calculate the moment of inertia of a ring ?

14. Derive the expression for damped oscillations.

15. Discuss the applications of static torsion.

16. Does the hammer of an elastic bell make free or forced vibrations when the bell is ringing ? Explain.

17. Explain why a loaded bus is more comfortable than an empty bus ?

18. Write down the exponential Fourier series expansion of the periodic signal $x(t) = 2\cos(2\pi t)$.

$(6 \times 2 = 12)$

Part C (Problems /Derivations)

Answer any **four** *questions.*
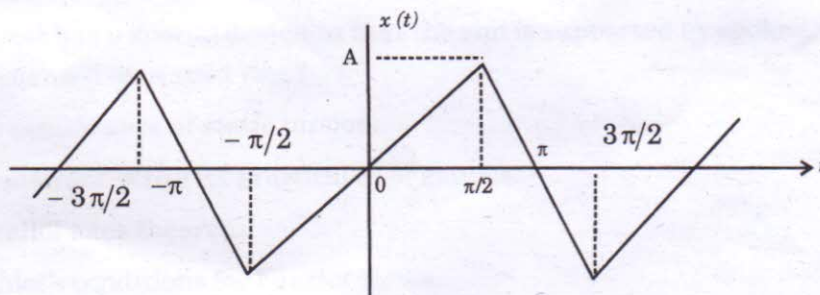*Each question carries 4 marks.*

19. A wire 0.32 mm in diameter elongates by 1 mm when stretched by a force of 0.33 kg-wt and twists through 1 radian when equal and opposite torques of 145×10^{-7} N-m are applied at its ends. Find Poisson's ratio for the wire.

20. A 10 kg object is whirled in a horizontal circle on the end of a wire. The wire is 0.3 m long, has cross-section 10^{-6} m^2 and has breaking stress 4.8×10^7 N/m^2. What is the maximum angular speed the object can have ?

21. A Gramophone turntable rotating at 75 r.p.m. slows down uniformly and stops in 5 seconds after the motor is turned off.

    (a) Find its angular acceleration.

    (b) Number of revolutions made in this time.

22. A body of mass 5 kg acquires an acceleration of 10 rad/s^2 by an applied torque of 2 Nm. Calculate its moment of inertia and radius of gyration.

23. If the displacement of a moving particle at any time is given by $x = a \cos wt + b \cos wt$, show that the motion is SHM. If $a = 4$ and $b = 5$ and $w = 2$, then calculate the period, maximum velocity and maximum acceleration.

24. A mass of 500 gm hungs from a spring. If the mass is pulled downward and let it go, it executes SHM. Calculate the time period if the same spring is stretched 16 cm by 400 gm mass.

$(4 \times 4 = 16)$

Part D (Essay /Problems)

Answer any **two** *questions.*
Each question carries 12 marks.

25. Show that for a light cantilever of length l and carrying a load w at its free end, the depression of a point x distance apart from fixed end is given by $y = \dfrac{W}{YI}\left(\dfrac{lx^2}{2} - \dfrac{x^3}{6}\right)$ where I is the geometrical moment of inertia.

26. Define modulus soft rigidity n. Show that a tangential stress T is equivalent to a tensile stress T_t and a compressive stress T_c at right angles to each other and also prove the relation $n = \dfrac{y}{2(1+\sigma)}$.

27. (a) Obtain the angular momentum of a rigid body about a fixed axis and define moment of inertia about the axis of rotation.

    (b) Establish a relation between the torque applied and the angular acceleration produced in a body about a given axis. What is the effect of torque on the rotation of the body ?

28. Obtain the Fourier series of the following function :

$(2 \times 12 = 24)$