Reg. No..... Name..... **U142**

B.Sc. DEGREE END SEMESTER EXAMINATION OCTOBER 2016

SEMESTER - 1**: PHYSICS (COMPLEMENTARY) FOR BSC MATHEMATICS**

COURSE - **15U1CPPHY1: PROPERTIES OF MATTER, MECHANICS AND FOURIER ANALYSIS**

Common for Regular (2016 Admission) & Supplementary / Improvement (2015 Admission)

Time: Three Hours Max. Marks: 60

Part A

Answer **all** questions, 1 mark each

1. What is known as modulus of Elasticity? Give its dimensions.
2. When the applied force to deform a body is withdrawn, the temperature of the body rises. Why?
3. Write down the relation between linear strain and volume strain.
4. Explain the centre of mass of a system of particles.
5. Can a pendulum clock be used in an earth-satellite? Why?
6. What is meant by Fourier analysis?
7. “Not all oscillatory motion is simple harmonic, but simple harmonic motion is always oscillatory”.
   Explain this statement and give an example to support your explanation.
8. What did Fourier discover about complex periodic wave pattern?

(1 x 8 = 8)

Part B

Answer **any six** questions, 2 marks each (Total 12 marks)

9. Mention the assumptions made in the theory of bending.
10. A hollow sphere filled with water is used as the bob of a pendulum. If the water slowly leaks out
    of the bob, how will the time period vary? Explain
11. State Dirichlet’s condition.
12. What do you understand by flexural rigidity? Give the expression in terms of bending moment.
13. What is a flywheel? Explain two uses of flywheel.
14. Explain how you will determine the direction of the angular velocity of a rigid body which rotates
    about an axis.
15. How do ballet dancers change their speed during their performances?
16. Mention one of the utility of Fourier transformation in physics with an example.

(2 x 6 = 12)

Part C

Answer **any four** questions, 5 marks each

17. A circular hoop of mass 1 kg and radius 0.3 m makes 10 revolutions per second about an axis passing through its centre and normal to the plane of the hoop. Find the M.I and angular momentum about the axis.

18. Calculate the work done in twisting the rod of diameter 2mm, and length 50 cm through 45^0. The rigidity modulus of steel is 8×10^{10} Nm^{-2}.

19. Find the Fourier integral representation of the function

$$f(x) = \begin{cases} 1 & \text{if } |x| \leq 1, \\ 0 & \text{if } |x| > 1. \end{cases}$$

20. A car moves with a velocity of 15 m/s. The radius of the wheel is 35 cm. Find the torque transmitted by the brakes to a wheel if the car is brought to rest in 15 sec. [M.I of wheel 3 kg-m^2.

21. A bar has a cross section of $0.01m^2$.It is supported by two knife edges 1 m apart, a mass of 1 kg is suspended at its mid-point which produces a depression of 2.51×10^{-3} m at the mid-point. Find the Young's modulus of the material of the bar.

22. A butcher throws a cut of meat on to a spring balance which oscillates about the equilibrium
position with a period of T = 0.500 s. The amplitude of the vibration is A = 2.00×10^{-2} m (path
length 4.00 cm). Find:
    a. frequency
    b. the maximum acceleration
    c. the maximum velocity
    d. the acceleration when the displacement is 1.00 cm
    f. the equation of motion as a function of time if the displacement is A at t = 0

(5 x 4 = 20)

Part D

Answer **any two**, 10 marks each (Total 20 marks)

23. Describe with theory the determination of the rigidity modulus of the material of a wire using the Torsion pendulum method.

24. A. State and prove the general theorems on moment of inertia.
    B. Derive an expression for moment of inertia of a thin uniform rod about an axis through its
    centre and perpendicular to its length.

25. Discuss the theory of forced oscillations. Draw the frequency response curve of a forced
harmonic oscillator indicating resonance. Define sharpness of resonance.

26. Discuss how to arrive at Fourier integral from Fourier series. Discuss also conditions for

convergence. Represent $f(x) = e^{-x},\ x > 0$ (a) by a cosine integral and (b) by a sine integral.

(10 x 2 = 20)

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