B.Sc. DEGREE EXAMINATION —
JUNE, 2018.

First Year
Mathematics

DIFFERENTIAL EQUATIONS

Time : 3 hours
Maximum marks : 75

PART A — (5 × 5 = 25 marks)

Answer any FIVE questions.

1. Solve: \( \frac{dy}{dx} + y \cot x = \sin 2x \).

2. Solve: \( \frac{d^2y}{dx^2} - 3 \frac{dy}{dx} + 2y = 0 \).

3. Solve: \( \frac{dx}{y^2} = \frac{dy}{-xy} = \frac{dz}{x(z - 2y)} \).

4. Solve: \( p + q = \sin x + \sin y \).

5. Solve: \( p^2z^2 + q^2 = 1 \).
6. Find $L\left(\frac{e^{3t} - e^{-2t}}{t}\right)$.

7. Show that $L\left(e^{-at}f(t)\right) = F(s+a)$ where $F(s) = L(f(t))$.

8. Find the particular integral to 
$$(D^2 - 4D - 12)y = \sin x \sin 2x.$$

PART B — (5 × 10 = 50 marks)

Answer any FIVE questions.

9. Solve: $xy p^2 + (x + y) p + 1 = 0$.

10. Solve: $(D^2 - 4D + 3)y = x^3 e^{2x}$.

11. Solve by method of variation of parameters
$$\frac{d^2y}{dx^2} + y = \csc x.$$

12. Solve $(mz - ny)dx + (nx - lz)dy + (ly - mx)dz = 0$.

13. Solve $(y^3 x - 2x^4)p + (2y^4 - x^3 y)q = qz \left(x^3 - y^3\right)$.
14. Solve \( \frac{dx}{dt} = 2x - 3y \), \( \frac{dy}{dt} = y - 2x \) using Laplace transforms given that \( x(0) = 8 \), \( y(0) = 3 \).

15. Solve: \( (p^2 + q^2)y = qz \).

16. Solve: \( (x^2D^2 - 2xD - 4)y = x^2 + 2 \log x \).
B.Sc. DEGREE EXAMINATION –
JUNE, 2018.

First Year

Physics

MECHANICS, PROPERTIES OF MATTER
AND SOUND

Time : 3 hours Maximum marks : 75

PART A — (5 × 3 = 15 marks)

Answer ALL questions.

1. State and explain the law of conservation of linear momentum.

2. State Kepler’s laws of planetary motion.

3. Find the energy stored in a wire of 5 m long and
   $10^{-2}$ m in diameter when it is stretched through
   $3 \times 10^{-3}$ m by a load. Young's modulus of material
   is $2 \times 10^{11}$ N/m².
4. Water flows through a horizontal tube of length 0.2 m and internal radius is $8.1 \times 10^{-4}$ m, under a constant load of the liquid 0.2 m high. In 12 minutes $8.64 \times 10^{-4}$ m$^3$ of liquid issues from the tube. Calculate the coefficient of viscosity of water. (Density of water = 1000 kg m$^{-3}$, g = 9.81 ms$^{-2}$).

5. Write down the properties of simple Harmonic motion.

PART B — (5 x 12 = 60 marks)

Answer ALL questions.

6. (a) Show that the path of a projectile is parabola.

   Or

   (b) Find the velocities and direction of the smooth spheres after oblique impact.

7. (a) Describe how you can calculate G using boys method.

   Or

   (b) Calculate the Gravitational field at a point due to spherical shell.
8. (a) Explain with necessary theory, how you can determine the rigidity modulus of a wire using torsion pendulum.

Or

(b) Derive an expression for the bending of a bar supported at two ends and loaded in the middle. Describe the experiment to determine 'E' by bending.

9. (a) Derive the Poiseville’s formula for the rate of flow of a liquid through a capillary tube. Describe laboratory method for determining the coefficient of viscosity of a liquid at room temperature.

Or

(b) State and explain Bernoulli’s theorem. Also explain how you can measure the amount of flow of liquid in a pipe using venturi meter.

10. (a) Determine the frequency of a tuning fork using Melde’s string experiment.

Or

(b) Explain the properties and applications of ultrasonics.
PART A — (5 × 3 = 15 marks)

Answer ALL questions.

1. Write the different methods to minimize spherical aberration.

2. Write the condition for dark and bright fringes due to interference.

3. Define the resolving power of a microscope.

4. State Brewster’s law.

5. What is Raman effect?
PART B — (5 × 12 = 60 marks)

Answer ALL questions.

6. (a) Describe with theory the construction of Huygen’s eyepiece.

Or

(b) Explain how two narrow angled prisms of different dispersive powers may be combined to produce dispersion without deviation and deviation without dispersion.

7. (a) Describe the construction and working of a Michelson interferometer.

Or

(b) Explain how will you determine the thickness of a thin wire using air wedge with necessary theory.

8. (a) Give the theory of zone plate.

Or

(b) Discuss the phenomenon of Fraunhofer diffraction at a single slit.
9. (a) Describe the construction and working of a Laurent's half shade polarimeter.

Or

(b) Explain the construction, action, limitation and uses of Nicol prism.

10. (a) Derive the two Einstein's coefficients.

Or

(b) Explain the construction and working of a semiconductor laser.