

**R16**

Code No: 132AB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year II Semester Examinations, April - 2018

MATHEMATICS-II

(Common to EEE, ECE, CSE, EIE, IT, ETM)

Time: 3 hours

Max. Marks: 75

**Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART- A****(25 Marks)**

- 1.a) Find  $L\{t^2 u(t-1)\}$ . [2]
- b) Obtain the inverse Laplace transform of  $F(s) = \cot^{-1} s$ . [3]
- c) Find the value of  $\Gamma\left(\frac{-1}{2}\right)$ . [2]
- d) Evaluate  $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$  using Beta and Gamma functions. [3]
- e) Evaluate  $\iint_R \sqrt{x^2 + y^2} dx dy$  by changing to polar coordinates, where  $R$  is the region in the  $xy$ -plane bounded by the circles  $x^2 + y^2 = 1$  and  $x^2 + y^2 = 4$ . [2]
- f) Find the value of the triple integral  $\int_0^{2\pi} \int_0^{\frac{\pi}{4}} \int_0^1 r^2 dr d\theta d\phi$ . [3]
- g) Find the normal vector and unit normal vector to the surface  $z^2 = x^2 - y^2$  at  $(2, 1, \sqrt{3})$ . [2]
- h) If  $\vec{a}$  is a constant vector and  $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ , prove that  $\text{div}(\vec{a} \times \vec{r}) = 0$ . [3]
- i) Evaluate  $\int_c (x^2 + yz) dz$ , where  $c$  is given by  $x=t, y=t^2, z=3t, 1 \leq t \leq 2$ . [2]
- j) State Gauss's divergence theorem. [3]

**PART-B****(50 Marks)**

- 2.a) Find the Laplace transform of  $f(t) = e^{-t} \left[ \int_0^t \frac{\sin u}{u} du \right]$ .
- b) Find the Laplace transform of the periodic function  $f(t) = t, 0 \leq t \leq a, f(t+a) = f(t)$ . [5+5]

**OR**

3.a) Obtain  $L^{-1} \left\{ \frac{s}{(s^2 + 1)^2} \right\}$  using convolution theorem.

b) Solve the initial value problem  $y'' + 3y' + 2y = e^{-t}$ ,  $y(0) = 0$ ,  $y'(0) = -1$  using Laplace transforms. [5+5]

4.a) Evaluate  $\int_0^{\infty} x^4 e^{-2x^2} dx$ .

b) Prove that  $\beta(m, n) = \int_0^1 \frac{x^{m-1} + x^{n-1}}{(1+x)^{m+n}} dx$ . [5+5]

OR

5.a) Prove that  $\beta(m, n) = 2 \int_0^{\pi/2} \sin^{2m-1} \theta \cos^{2n-1} \theta d\theta = \beta(m+1, n) + \beta(m, n+1)$ .

b) Prove that  $\int_0^1 x^m (\ln x)^n dx = \frac{(-1)^n n!}{(m+1)^{n+1}}$  where  $m > 1$  and  $n$  is a positive integer. [5+5]

6.a) Change the order of integration in  $\int_0^1 \int_{x^2}^{2-x} xy dx dy$  and hence evaluate the same.

b) Find the area of the region bounded by the parabolas  $y^2 = 4x$  and  $x^2 = 4y$ . [5+5]

OR

7.a) Evaluate  $\iiint_v (1-x) dx dy dz$ , where  $v$  is the space in the first octant below the plane  $3x + 2y + z = 6$ .

b) Find the volume of the solid enclosed between the surfaces  $x^2 + y^2 = 4$  and  $x^2 + z^2 = 4$ . [5+5]

8.a) Find the values of  $a$  and  $b$  so that the surface  $ax^2 - byz = a + 2$  is orthogonal to the surface  $4x^2 y + z^3 = 4$  at  $(-1, -1, 2)$ .

b) Find the directional derivative of the scalar function  $f(x, y, z) = xyz$  at  $(1, 4, 9)$  in the direction of the line from  $(1, 2, 3)$  to  $(1, -1, -3)$ . [5+5]

OR

9.a) If  $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$  and  $r = |\vec{r}|$ , show that  $\nabla \cdot \left( \frac{\vec{r}}{r^3} \right) = 0$ .

b) Prove that  $\text{curl}(\text{curl } \vec{v}) = \nabla(\nabla \cdot \vec{v}) - \nabla^2 \vec{v}$ . [5+5]

10.a) Show that  $\int_c (2xy+3)dx + (x^2-4z)dy - 4ydz$ , where  $c$  is any path joining  $(0, 0, 0)$  to

$(1, -1, 3)$ , does not depend on the path  $c$  and evaluate the integral.

b) Apply Stoke's theorem to evaluate  $\oint (x+y)dx + (2x-z)dy + (y+z)dz$ , where  $c$  is the boundary of the triangle with vertices  $(2, 0, 0)$ ,  $(0, 3, 0)$  and  $(0, 0, 6)$ . [5+5]

OR

11. Verify Green's theorem for  $\oint_c e^{-x}(\cos y dx - \sin y dy)$ , where  $c$  is the rectangle with

vertices  $(0,0)$ ,  $(\pi,0)$ ,  $(\pi, \frac{\pi}{2})$  and  $(0, \frac{\pi}{2})$ . [10]

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**R16**

Code No: 132AF

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year II Semester Examinations, April - 2018

APPLIED PHYSICS

(Common to CE, ME, MCT, MMT, AE, MIE, PTM, CEE, MSNT)

Time: 3 hours

Max. Marks: 75

**Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART- A****(25 Marks)**

- |      |   |     |
|------|---|-----|
| 1.a) | Write down Hooke's law.                         | [2] |
| b)   | Define rigidity modulus and also mention units. | [3] |
| c)   | Write down the Sabine's formulae                | [2] |
| d)   | What are the limitations of Sabine's formula?   | [3] |
| e)   | What are ultrasonic waves?                      | [2] |
| f)   | Write the applications of ultrasonic waves.     | [3] |
| g)   | Define polarizability and susceptibility.       | [2] |
| h)   | Write short notes on piezoelectricity.          | [3] |
| i)   | What is superconductivity?                      | [2] |
| j)   | Explain the origin of magnetization.            | [3] |

**PART-B****(50 Marks)**

- |           |   |       |
|-----------|---|-------|
| 2.a)      | Derive the expression of work done for unit volume in deforming a body.                               |       |
| b)        | Explain the determination of rigidity modulus using torsional pendulum.                               | [5+5] |
| <b>OR</b> |   |       |
| 3.a)      | Discuss about elastic behavior of a material and factors affecting elasticity.                        |       |
| b)        | Explain about relation between three moduli of elasticity.  | [5+5] |
| 4.a)      | State the acoustic requirements of a good auditorium. Explain how these requirements can be achieved. |       |
| b)        | Derive the Sabine's formula for reverberation time.   | [5+5] |
| <b>OR</b> |   |       |
| 5.a)      | Explain how the absorption coefficient of an acoustic material can be determined.                     |       |
| b)        | State any five factors affecting the acoustics of the building and suggest their remedies.            | [5+5] |
| 6.a)      | Explain the phenomenon of magnetostriction.   |       |
| b)        | Determine the velocity of sound in a liquid with a neat sketch.                                       | [5+5] |
| <b>OR</b> |   |       |
| 7.a)      | What is the piezoelectric effect? Explain the production of ultrasonic using piezoelectric crystal.   |       |
| b)        | Explain the use of ultrasonic waves for non-destructive testing and in SONAR.                         | [5+5] |

8.a) What are the important characteristics of ferroelectric materials?

b) Derive Clausius-Mosotti relation for dielectrics.

[5+5]

OR

9.a) Derive an expression for ionic polarizability.

b) Explain the phenomenon of ferroelectricity with particular reference to Barium Titanate.

[5+5]

10.a) What is meant by domain? Explain the importance of hysteresis curve.

b) Explain the properties of Anti-ferro and ferri magnetic materials.

[5+5]

OR

11.a) Explain the properties of superconductors and write types of superconductors.

b) Briefly discuss about Meissner Effect.

[5+5]

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