[117 & A-61] **SARDAR PATEL UNIVERSITY**
Vallabh Vidyanagar
M. Sc. (Physics) 1ˢᵗ Semester Examination (NC)
Tuesday, 10ᵗʰ April, 2018
Time: 02:00 pm to 05:00 pm
Subject: PS01CPHY01 [Mathematical Physics & Computer Programming]-**Old Course**

Total Marks: 70

Note: (1) Figures to the right indicate marks.
      (2) Symbols have their traditional meaning.

Q:1   Attempt all of the following Multiple choice type questions. [01 mark each]   [08]

(1)   Two vectors $\vec{a}_1$ and $\vec{a}_2$ are defined as linearly dependent if two numbers x_1 and x_2 can be found such that

   (a) $x_1 \neq 0 \; x_2 \neq 0$ (c) $x_1 = 0 \; x_2 \neq 0$
   (b) $x_1 = 0 \; x_2 = 0$ (d) $x_1 \neq 0 \; x_2 = 0$

(2)   The eigen values of matrix $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ are

   (a)   1,2   (c)   0,2
   (b)   1,0   (d)   1,1

(3)   If $z = re^{i0}$ then $|dz|$ equals
   (a)   r d0   (c) e^{i0}
   (b)   1   (d)   r dz

(4)   The sum of a complex number and its conjugate is
   (a)   complex   (c)   real
   (b)   zero   (d)   imaginary

(5)   If the correspondence between elements of two groups preserves group multiplication then the two group are
   (a)   commutative   (c)   isomorphic
   (b)   abelian   (d)   homomorphic

(6) $\{\delta(t)\} = 1$ is also called
   (a)   impulse function.   (c)   eigen function.
   (b)   Heaviside function.   (d)   Laplacian function

(7)   Which of the following is a valid real constant
   (a)   11,000.0   (c)   237
   (b)   120.33   (d)   13.0°

(8)   Which is the correct precedence of arithmetic operators
   (a)   Unary - ; ** ; *,/ ; +,-   (c) Unary - ; *,/ ; +,- ; **
   (b)   Unary - ; ** ; +,- ; *,/   (d) ** ; *,/ ; +,- ; Unary -

(P.T.O.)

:1:

Q:2　　Answer any 7 of the following 9 questions briefly. [02 marks each]　　[14]

1　Show that Eigen values of a Hermitian operator are real.
2　Explain quotient rule.
3　What are linearly independent vectors and unitary operators?
4　Define (i) simply connected region (ii) essential singularity
5　Is $f(z) = z^2$ analytic?
6　Define simple pole and Laurent series.
7　Describe Parseval's relation.
8　Give example of a DO loop.
9　Give the general structure of a FORTRAN program.

Q:3　(a)　Write a note on dual vectors and Cauchy-Schwarz inequality.　　[6]

(b)　Prove that $A = \begin{pmatrix} -xy & x^2 \\ -y^2 & -xy \end{pmatrix}$ is a tensor.　　[6]

OR

(b)　A covariant tensor has components xy, $2y-z^2$, xz in rectangular co-ordinates. Find its covariant components in spherical co-ordinates.　　[6]

Q:4　(a)　Using Cauchy's second integral theorem show that the nth order derivative of an analytic function is given as $f^{(n)}(z_0) = \dfrac{n!}{2\pi i} \oint_c \dfrac{f(z)}{(z-z_0)^{n+1}} dz$　　[6]

(b)　Find the residue of $f(z) = \dfrac{z^4}{(z-1)^3(z-2)(z-3)}$ at $z = 1$.　　[6]

OR

(b)　Obtain Green's function for the boundary value problem defined by $\dfrac{d^2 y}{dx^2} - k^2 y = f(x)$ with $y(\pm\infty) = 0$.　　[6]

Q:5　(a)　Show that Fourier transform can be used to resolve a finite pulse into sinusoidal waves.　　[6]

(b)　Write a note on group, its representation and character. Using an illustration explain the group multiplication table.　　[6]

OR

(b)　Solve a damped harmonic oscillator problem using Laplace transform.　　[6]

:2:

Q:6   (a)   Explain with proper examples, INPUT-OUTPUT statements.   [6]

      (b)   Write a note on subroutines.   [6]

                                       OR
      (b)   Explain with the help of suitable examples, constants and variables.   [6]

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