No. of Printed Pages: 02

(30)

SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

M. Sc. (Physics) 1st Semester Examination

Tuesday, 21st April, 2015

Time: 10:30 am to 01:30 pm

Subject: PS01CPHY01 [Mathematical Physics & Computer Programming]

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) The number of components in a tensor of rank 2 in 3 dimensional space is
(a) 9 (c) 27
(b) 3 (d) 81

(2) A technique for creating new, higher rank tensors is
(a) Inner product (c) Cauchy-Schwartz inequality
(b) direct product (d) quotient rule

(3) $\oint_c \frac{z^2}{z-2}$ where c is $|z|$ 1 is
(a) 0 (c) πi
(b) $2\pi i$ (d) $4\pi i$

(4) For a complex variable z, $z+z^*$ is equal to
(a) zero (c) imaginary
(b) real (d) complex

(5) The Laplace transform of 1 i.e. £{1} is
(a) s^2 (c) 1/s
(b) 1 (d) s

(6) Integral transform based on the kernel $e^{i\omega t}$ if known as
(a) Laplace transform (c) Mellin transform
(b) Henkel transform (d) Fourier transform

(7) For a DO loop, DO I = -10,2 the number of iterations will be
(a) 10 (c) 13
(b) 0 (d) 12

(8) If i=45 then 10*i/10 gives
(a) 4.5 (c) 0
(b) 40 (d) 45

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

1 Define (i) unitary operator (ii) eigen value.
2 Explain quotient rule.
3 Show that z^2 is analytic.
4 Define complex quantity. Show that zz* is a real quantity.
5 Define Laplace transform.
6 Explain the term "convolution".
7 Explain IF-ELSEIF statement using example.
8 Write full form of FORTRAN. How is a FORTRAN program compiled?
9 Define with suitable examples constants and variables.

Q:3 (a) Define Hermitian operator and prove that its Eigen values are real quantities. Also explain projection operators. [6]

(b) Write note on types of tensors and their algebra. [6]

OR

(b) Write notes on (i) covariant derivative (ii) geodetic equation. [6]

Q:4 (a) If f(z) is a single valued and analytic throughout a simply connected region R, and if c is any closed contour interior to R and enclosing z_0, then show that $f(z_0) = \frac{1}{2\pi i}\oint_c \frac{f(z)}{(z-z_0)}$. [6]

(b) Define Green's function. Obtain Green's function for $\frac{d^2y}{dx^2} - k^2 y = f(x)$ where $y(\pm\infty) = 0$. [6]

OR

(b) Discuss in short conformal mapping. Discuss the mapping of $w=z^2$. [6]

Q:5 (a) Obtain Laplace transform for the damped oscillator. [6]

(b) Using proper integral transform, explain how a finite pulse could be resolved into sinusoidal waves. [6]

OR

(b) With proper illustrations, write a detailed note on the group concept in various branches of physics. [6]

Q:6 (a) Write a short note on DO loops. Write a FORTRAN90 program to compute the sum of even integers making use of DO loops. [6]

(b) Write short notes on (i) arithmetic expressions (ii) input-output statements. [6]

OR

(b) Explain format specifications with the help of suitable examples. [6]

-X-