Enrollment No: ______________________ Exam Seat No:______________________

C.U.SHAH UNIVERSITY

Summer Examination-2020

Subject Name : Mathematical Physics
Subject Code : 5SC01MTP1 Branch: M.Sc. (Physics)
Semester : 1 Date : 24/02/2020 Time : 02:30 To 05:30 Marks : 70

Instructions:

(1) Use of Programmable calculator and any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

SECTION – I

Q-1		**Attempt the Following questions**	**(07)**
	a.	Distinguish Scalars and Vectors giving at least two points of each.	(01)
	b.	Define: Tensors.	(01)
	c.	What is Rank or Order of Tensors?	(01)
	d.	State N-dimensional space.	(01)
	e.	Explain subscript and superscript.	(01)
	f.	Define Adjoint Tensor with suitable examples.	(01)
	g.	What is Conjugate Tensor? State with examples.	(01)
Q-2		**Attempt all questions**	**(14)**
	(A)	Discuss various properties of tensors.	(06)
	(B)	Explain applications of tensors in various fields of science and technology.	(08)
		OR	
Q-2		**Attempt all questions**	**(14)**
	(A)	Write notes on (1) indicial notation and (2) contraction of indices.	(07)
	(B)	Describe the term indicial summation conventions and dummy indices.	(07)
Q-3		**Attempt all questions**	**(14)**
	(A)	Differentiate Anti(Skew) symmetric tensors and Symmetric tensors with giving examples of each.	(07)
	(B)	Explain Co-variant and Contra-variant tensors in brief.	(07)
		OR	
Q-3		**Attempt all questions**	**(14)**
	(A)	Prove Algebraic operations of Tensors: The sum and difference of two tensors of the same rank results in another tensor of the same rank. Moreover, if F_{kl} & G_{kl} are tensors of the same rank then $(a\,F_{kl} \pm b\,G_{kl})$ is also a tensor of the same rank-order; where, a and b are any numbers.	(07)
	(B)	Prove the Quotient Rule: If $A_i B_{lk}$ is a tensor for all contra-varient tensors A_i then B_{lk} is also a tensor.	(07)

SECTION – II

Q-4 **Attempt the Following questions.** **(07)**

a. What is meant by a differential equation?Give name different types of differential equations. (01)

b. What are the 'degree' and 'order' of a differential equation? (01)

c. State ordinary differential equations. (01)

d. Explain partial differential equations. (01)

e. Define linear Differential Equations. (01)

f. State complex numbers and identify each of its parts. (01)

g. What is the differentiability of a complex function? (01)

Q-5 **Attempt all questions** **(14)**

(A) State Cauchy Riemann theorem. Discuss the Cauchy-Riemann theorem by deriving the necessaryCauchy-Riemann conditions$\left\{\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y} \;\; ; -\frac{\partial u}{\partial y} = \frac{\partial v}{\partial x}\right\}$ for a function to be analytic. (07)

(B) State and discuss the Cauchy-Riemann theorem by deriving the sufficientCauchy-Riemann conditions $\left\{\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y} \;\; ; \frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}\right\}$ for a analytic function. (07)

OR

Q-5 **Attempt all Questions.** **(14)**

(A) If the function $f(z)$is analytic within and on a closed contour c and if z_0 is any point within c, then prove Cauchy's integral formula$f(\, z_0 \,) = \frac{1}{2\pi i} \int \frac{f(z)}{z - z_0} \, dz.$ (09)

(B) Develop Cauchy's integral formula for the derivative of an analytic function by deriving $f'^{\,n}(z_0) = \left(\frac{2!}{2\pi i}\right) \int \frac{f(z)}{(z-z_0)^{n+1}} \, dz.$ (05)

Q-6 **Attempt all questions** **(14)**

(A) Explain Taylor's theorem briefly. (07)

(B) Write the statement of Laurent's theorem and prove it. (07)

OR

Q-6 Derive the solution of following Legendre's differential equation: $(1 - x^2)y'' - 2x\,y' + n(n+1)y = 0$ by the ascending and descending power of variable. **(14)**