UNIVERSITY OF THE PUNJAB

Part-I A/2017
Examination:- M.A./M.Sc.

Roll No. .....

Subject: Space Science **TIME ALLOWED: 3 hrs.**
PAPER: I (Mathematical Techniques & Quantum Mechanics) **MAX. MARKS: 100**

NOTE: Attempt any 5 questions. Attempting atleast "2" from each Section. All questions carry equal marks.

Section-I

Q.1 State and explain Schrodinger's wave equation and derive Time Independent Schrodinger equation. (20)

Q.2 Find the total energy of particle moving inside "one dimensional box" also calculate the wave function for quantum number "n". (20)

Q.3 State Hermition operator and prove that eigen value of Hermition operator is always real. Prove that sum of two different Hermition operators is also Hermition. (20)

Q.4 State and explain Heisenberg uncertainty principle. And give rigorous derivation of uncertainty relationship according to Heisenberg uncertainty principle. (20)

P.T.O.

Section-II

Q.5 a) Find the general power series solution for the Legendre equation. (10)

$$(1-x^2)y'' - 2xy' + \lambda(\lambda+1)y = 0.$$

b) Evaluate $\oint_C |z|^2\, dz$ around the square with vertices at (0,0), (1,0), (1,1) and (0,1).

(10)

Q.6 a) Evaluate the Fourier series of the function $\cos\left(\frac{t}{2}\right)$ over the interval $[-\pi, \pi]$.

(10)

b) Using Laplace Transformation, solve the problem (10)

$\frac{\partial^2 w}{\partial t^2} = 4\frac{\partial^2 w}{\partial x^2}$, $(0 < x < 1, t > 0)$ with the conditions $w(x,0) = \sin \pi x, w_t(x,0) = -\sin \pi x, w(0,t) = 0$ and $w(1,t) = 0$.

Q.7 Use the method of Frobenius to find the series solution of differential equation

$$(x^2+2)y'' + 3xy' - y = 0.$$

(20)

Q.8 a) Prove the necessary and sufficient condition that $w = f(z) = u(x,y) + iv(x,y)$ be analytic in a region R is that Cauchy-Riemann equations $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$, $\frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$ are satisfied in R where it is supposed that these partial derivatives are continuous in R.

(10)

b) Evaluate $\lim_{z\to 0}\left(\frac{\sin z}{z}\right)^{1/z^2}$. (10)

Q.9 a) Evaluate $\frac{1}{2\pi i}\oint_C \frac{e^{zt}}{z^2+1}\, dz$, for $t > 0$ and C is the circle $|z| = 3$.

(10)

b) Find the Taylor series expansions for the function $(1-x)^{-k}$ for $k = 2, 3, \ldots$.

(10)

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Subject: Space Science **TIME ALLOWED: 3 hrs.**
PAPER: II (Meteorology & Climatology) **MAX. MARKS: 100**

NOTE: Attempt any FIVE questions in total by choosing at least TWO questions from each section. All questions carry equal marks.

SECTION-I

Q-1	Explain Bergeron process and Coalescence process for precipitation formation?	**20**
Q-2	Explain the following: a) Relative humidity b) Absolute humidity c) Mixing ratio	**20**
Q-3	Describe the types of High, Middle and Low clouds with structures and heights?	**20**
Q-4	Describe the Cumulonimbus CB cloud growth, stages and its decay?	**20**
Q-5	Explain the process of convergence and divergence in a Low and High pressure with diagram?	**20**

SECTION-II

Q-6	Discuss the role of observation Satellites for climate assessment?	**20**
Q-7	Discuss human impact on climate?	**20**
Q-8	Explain the role of Greenhouse gases and Carbon dioxide gas on climate change?	**20**
Q-9	Describe: a) Components of climate system b) Controlling factors of climate	**20**

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Subject: Space Science
PAPER: III (Astronomy)

TIME ALLOWED: 3 hrs.
MAX. MARKS: 100

NOTE: *Attempt any **FIVE** question selecting at least **one** question from each section. All questions carry equal marks. Support your answers with diagrams/ figures etc.*

Section I

Q-1		Define an interval. What are space-like and time-like intervals. Explain the concept of light cone of an event by considering various regions such as absolute past, absolute future and absolute remote?	**20**
Q.2	(a)	Discuss the motion of a charged particle in Transverse Electric field?	**10**
	(b)	State and derive a relationship for the Aberration of Light?	**10**
Q-3		Discuss Lorentz Transformation and its consequences?	**20**

Section II

Q.4		Describe Horizontal and Equatorial system of coordinates to specify position over Celestial sphere. Also derive mathematical relation for their interconversion?	**20**
Q.5	(a)	What is Equation of Time. Give its significance graphically?	**10**
	(b)	State and derive the Kepler's Third law?	**10**
Q.6	(a)	A ship Streams Eastwards along the parallel of latitude From A to B at 15 knots. Find the longitude of B , given that the position of A and the duration of run is as A(35°40′ N, 162° E) : 2 days 20 hours	**10**
	(b)	'Name all the Zodiac constellations. Explain Orion and Big Dipper?	**10**

(P.T.O)

Section III

Q.7	**(a)**	What is a Solar Eclipse. Describe the occurrence of the solar eclipse with diagram. Why there is not a solar eclipse every month?	**10**
	(b)	Explain the Sun spots in detail?	**10**
Q.8	**(a)**	What are Asteroids. How are they formed?	**10**
	(b)	Discuss different theories about the origin of Moon?	**10**
Q.9		Write motes on any TWO of the following:	**20**

i. The Big Bang Model
ii. Earth Moon System
iii. Meteorites

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Subject: Space Science
PAPER: IV (Electronics)

TIME ALLOWED: 3 hrs.
MAX. MARKS: 100

NOTE: Attempt any FIVE questions selecting at least TWO questions from each section. All questions carry equal marks.

Section 1

1 a. Write biasing options for a BJT Transistor.

b. Describe the working of a Centre taped full wave Rectifier Circuit.

2 a. Draw Circuit Diagram of MOSFET, Explain its operation?

b. What is an operational amplifier? Write its two applications with diagrams

3 a. Write 8 advantages/ disadvantages of JFET over BJT.

b. Write a detailed note on Parity Codes and their significance.

4 a. How a Zener Diode constructed? Give examples of its applications.

b. Briefly explain two types of Oscillators.

5 a. Define, draw and explain the working a Bridge Full wave rectifier

b. Write note on Digital Signal Processing

Section II

6 a. Explain the working principle of a shift register, what are its applications

b. What is a Gray Code? , Write the conversion process of a Gray code to Binary and its vice versa.

7 a. Write notes on Multiplexers and De-multiplexers with diagrams

b. Define and Compare Asynchronous and Synchronous Counters

8 a. Convert the following, (i) 0.77_{10} into Binary (ii) $B2F8_{16}$ into Decimal

b. Describe the Parity Method for error detection in a received data.

9 a. State De Morgan's theorem

b. What is a Karnaugh map? , Explain its limitations, Advantages and Disadvantages.

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Subject: Space Science **TIME ALLOWED: 3 hrs.**
PAPER:V (Remote Sensing & Image Processing) **MAX. MARKS: 100**

NOTE: Attempt any FIVE questions. All question carry equal marks. Draw diagrams where necessary.

1. What are the major Atmospheric Interactions? Discuss in detail the Selective Scattering and explain the blue sky manifestation. (4,10,6)

2. What are the spectral response patterns? How these patterns are affected by the presence or absence of atmospheric windows? Sketch, label and describe the spectral response pattern of Snow, in the range from visible to middle infrared region. (3,5,12)

3. Describe the meaning of resolution in Remote Sensing, Explain its different types and discuss the Trade-offs of Spatial resolution with Radiometric resolution, explain your answer with Landsat and Quick Bird sensors comparison. (3,12,5)

4. Describe the meaning of color, how the additive and primary colors are related in color triangular model and color cube model? Discuss True and False color composites of satellite imagery. (2,5,8,5)

5. How different sensors in remote sensing are classified, based on source of illumination? Sketch and describe the working of an optical mechanical scanner as a whisk broom scanner, and discuss its working as an eleven bit sensor with seven spectral bands. (8,8,4)

6. What are radiometric distortions? Discuss processes of correction for different radiometric distortions. (8,12)

7. What are different types of Spectral Enhancements? Discuss in detail the application of Histogram Equalization as a contrast enhancement scheme. (Elaborate your answer with an example). (4,16)

8. What is meant by satellite image classification? Describe its different types? Give a detailed account of the process of Unsupervised Classification, using the ISODATA classification method. (2,7,5,6)

9. Write note-on any **Two** of the following: (10,10)

   i. Landsat Program
   ii. Visual Interpretation Key
   iii. Radiometric Distortions