



UNIVERSITY OF THE PUNJAB

Part-I A/2016
Examination:- M.A./M.Sc.

Roll No.

Subject: Space Science
PAPER: I (Mathematical Techniques & Quantum Mechanics)

TIME ALLOWED: 3 hrs.
MAX. MARKS: 100

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

Section- I

Q.1 Solve the Schrodinger wave equation for a particle trapped in an infinitely deep well and show that the energy of the particle inside the well is quantized (20)

Q2. Calculate the eigen value spectrum of the operator L_z and also evaluate the effect of ladder operators on eigen value spectrum of this operator. (20)

Q.3 a) State interpretive postulates of quantum mechanics.
b) Show that Eigen vectors of Pauli-Spin Matrices are orthogonal and normalized to each other. (10, 10)

Q4 a) Give general statement of Heisenberg uncertainty principle.
b) Give rigorous derivation of uncertainty relationship according to Heisenberg's uncertainty principle. (10, 10)

P.T.O.

Section-II

Q.5 Discuss the spherical co-ordinate system and prove that co-ordinates of this system are orthogonal to each other. Also convert $(8, \frac{\pi}{4}, \frac{\pi}{6})$ into Cartesian co-ordinates. (20)

Q.6 a) Evaluate the Fourier series of the function $\frac{x^2}{e^x}$ over the interval $-\pi \leq x \leq \pi$.
 b) Define Laplace transform. Also find the Laplace transform of $\cos kt$. (10, 10)

Q.7 Find the general solution of the Bessel equation $4x^2y'' + 4xy' + (4x^2 - 25)y = 0$. (20)

Q.8 a) Prove that the function $u = 2x(1 - y)$ is harmonic. Find a function v such that $f(z) = u + iv$ is analytic and express $f(z)$ in terms of z .

b) Evaluate $\oint_c \frac{e^{3z} + 3 \cosh z}{(z - i\frac{\pi}{2})^4} dz$, where c is any closed contour containing the point $i\frac{\pi}{2}$. (10, 10)

Q.9 a) By using Laplace transform

Evaluate i) $\mathcal{L} \{ t^n e^{-\alpha t} \}$

ii) $\mathcal{L}^{-1} \left\{ \frac{s^2 - 2s}{(s+2)(s^2+1)} \right\}$

b) Prove that the generating function for Legendre's polynomial is given by

$$G(x, t) = \frac{1}{\sqrt{1-2xt+t^2}} = \sum_{n=0}^{\infty} P_n(x)t^n, \text{ where } P_n(x) \text{ are Legendre's polynomials.}$$

(5+5, 10)

UNIVERSITY OF THE PUNJAB



Part-I A/2016
Examination:- M.A./M.Sc.

Roll No.

Subject: Space Science
PAPER: II (Meteorology & Climatology)

TIME ALLOWED: 3 hrs.
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 1

- Q.1 Discuss formation, movement, growth & decay of mid-latitude cyclones. 20
- Q.2 Define & drive the clausius-clapeyron equation. 20
- Q.3 Discuss the classification, modification & movement of air masses. 20
- Q.4 Discuss all the stages from inception to dissipation of thunderstorm. 20
- Q.5 Define, formation, movement track of tropical cyclones over Bay of Bengal. 20

Section 2

- Q.6 Write a detailed note on 20
a) Carbon cycle
b) Green house effect
- Q.7 Discuss global observing system & its components 20
- Q.8 Discuss factors controlling climate. 20
- Q.9 Discuss in detail climatic classification. 20



UNIVERSITY OF THE PUNJAB

Part-I A/2016
Examination:- M.A./M.Sc.

Roll No.

Subject: Space Science
PAPER: III (Astronomy)

TIME ALLOWED: 3 hrs.
MAX. MARKS: 100

NOTE: Attempt any FIVE questions in all selecting at least ONE question from each section is compulsory. Support your answers with diagrams/charts/figures, where needed. All questions carry equal marks.

Section-I

- Q.1 a) What is difference between the general and special theory of relativity. Also write down the postulates of Einstein's special relativity. (10+10)
b) Write down Galilean Transformations equations and derive velocity transformations from them.

- Q.2 a) Derive formula of mass variation with velocity and prove that a material particle cannot have equal to or greater than velocity of light. (10+10)

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

- Q.3 a) Define and give properties of 4-vector (A_μ) in Minkowski's space. Also explain the terms "TIME LIKE INTERVAL" and "LIGHT-LIKE INTERVAL". (10+10)
b) Define properties and derive formula of 4-vector (A_μ).

Section-II

- Q.4 (a) Prove the following for a SPHERICAL TRIANGLE.

$$\cos a = \cos b \cdot \cos c + \sin b \cdot \sin c \cdot \cos A \quad (14+6)$$

- (b) A ship streams eastwards along the parallel of latitude from A (42° S, 63° W) to B (42° S, 10° E). find the distance streamed in nautical miles

- Q.5 (a) What are SIDERIAL and SYNODIC rotations of the EARTH? Why they have different time period? Discuss units of time based on these motions. (14+6)
(b) What is EQUATION OF TIME?

- Q.6 Describe HORIZONTAL and EQUATORIAL system of coordinates to specify position over CELESTIAL SPHERE. Also derive mathematical relation for their INTER-CONVERSION. (7+7+6)

Section-III

- Q.7 Discuss formation of SEASONS over Earth. How AXIAL TILT control temperature fluctuations over different planets? (12+8)

- Q.8 What is a PLANET? Write down the following for the JOVIAN PLANETS. (5+8+3+4)
I. Differential rotation
II. Self-source of energy
III. Planetary rings

- Q.9 Write notes on any two of the following (10+10)
I. ASTEROID BELT
II. COMETS
III. METEOR, METEORITE AND METEORIDE



UNIVERSITY OF THE PUNJAB

Part-I A/2016
Examination:- M.A./M.Sc.

Roll No.

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) Give advantages of Gray Code and Binary to Gray Code conversion method.
- 1(b) Convert the Decimal number 3.248×10^4 to a single precision floating point binary number.
- 2 (a) Convert the following hexadecimal numbers to decimal (i) E5 (ii) B2F8 10
- 2 (b) Write 12 basic rules of Boolean Algebra
- 3 (a) What are "Don't care" conditions and how they can be used to take advantage in Karnaugh map?
- 3 (b) Explain AND/OR implementation of a standard SOP expression.
- 4 (a) Write steps to convert Standard sum term to standard POS?
- 4 (b) Explain Exclusive OR logic using logic diagram

Section-II

- 5 (a) Draw maximum power dissipation curve and explain max. Transistor Ratings.
- 5 (b) How can transistor be used as a switch?
- 6 (a) How stability of C-E BJT amplifier can be improved by swamping?
- 6 (b) What is a Darlington Pair? Give its overall β and R_{in} .
- 7 (a) Define Voltage, current and power gains and give their formulae for C-E BJT Amplifier.
- 7 (b) Draw diagrams and explain D-MOSFET amplifier operation.
- 8 (a) Name all the JFET biasing techniques and explain one of these.
- 8 (b) How will you bias a push-pull amplifier for a class-C operation
- 9 Write note on two topics from following;
 - Cyclic Redundancy Check
 - Exclusive NOR logic & implementation for its POS & SOP expressions.
 - Emitter bias of a BJT? Discuss its Q-point stability

UNIVERSITY OF THE PUNJAB



Part-I A/2016
Examination:- M.A./M.Sc.

Roll No.

Subject: Space Science
PAPER: V (Remote Sensing & Image Processing)

TIME ALLOWED: 3 hrs.
MAX. MARKS: 100

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

1. Define REMOTE SENSING. Discuss its types with respect to sources of energy and sensor type. Discuss merits and demerit of AERIAL SEMOTE SENSING and SATELLITE REMOTE SENSING. (3, 9, 8)
2. How Electromagnetic Radiation interacts with earth atmosphere. Discuss Atmospheric Windows and their effect on remote sensing sensor design. Discuss the Reflectance Curve of water in visible and near infrared bands. (5,10,5)
3. Describe QUICK BIRD Satellite ORBIT and SENSOR CHARACTERISTICS. Compare SPATIAL, RADIOMETRIC and MULTISPECTRAL Characteristics of QUICK BIRD and LANDSAT-7. How it is possible to get QUICK BIRD images more frequently than SPOT or Landsat type of satellites? (10,10)
4. What is the TRI-STIMULI MODEL of color perception? Describe INTENSITY, HUE and SATURATION (IHS) perception model of color. (4,16)
5. What is PRINCIPAL COMPONENT ANALYSIS? How the technique is used to remove inter-band redundant information of multiple band data. Explain your answer with the help of equations and diagrams. Where the analysis is used in image processing? (4,12,4)
6. Describe Interaction of solar energy with earth features. What are the Spectral Signatures of an earth feature? Discuss the importance of Image Analysis. Describe with examples the elements of Visual Interpretation. (5,5,5,5)
7. State the principle of IMAGE CLASSIFICATION. Discuss different types of IMAGE CLASSIFICATION techniques. Give a detailed account of the process of SUPERVISED CLASSIFICATION, using MAXIMUM LIKELIHOOD CLASSIFICATION algorithm. (5,5,10)
8. Describe the meaning of COLOR. How ADDITIVE and PRIMARY COLORS are related in color CUBE MODEL? Discuss TRUE and FALSE COLOR composites of satellite imagery. How these composites enhance various land cover types? (2,7,5,6)
9. Write note-on any Two of the following: (10,10)
 - i. Visual Interpretation Key
 - ii. Change Detection
 - iii. Working mechanism of Satellite sensors