



UNIVERSITY OF THE PUNJAB

M.A./M.Sc. Part – I Annual Exam – 2019

Roll No.

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

Time: 3 Hrs. Marks: 100

**NOTE: Attempt any FIVE questions by attempting atleast TWO questions from each Section.
All questions carry equal marks.**

SECTION-I

Question No: 1

- a) Explain de Broglie's Hypothesis with experimental proof. 10
- b) State and explain Schrödinger's equation. 10

Question No: 2

- a) Calculate the total energy of particle moving inside "one-dimensional" box. 10
- b) What will be the wave function of a particle in one dimensional box? 10

Question No: 3

- a) State and explain Heisenberg's un-certainty Principal. 15
- b) Find the minimum energy of simple Harmonic oscillator by using uncertainty principal. 5

Question No: 4

- a) Define angular momentum and prove that "No two components of angular momentum commute" 15
- b) The energy of an electron in certain atom is approximately 1×10^{-18} J. How long would it take to measure the energy to a precision of 1%. 5

P.T.O.

Section-II

- Q.5 Use the method of Frobenius to find the following one solution [20]

$$J_p(x) = \sum_{k=0}^{\infty} \frac{(-1)^k x^{2k+p}}{2^{2k+p} k! \Gamma(p+k+1)}$$

of Bessel's equation of order p .

- Q.6 a) Find the power series solution of $\frac{d^2y}{dx^2} - 6x^2 \frac{dy}{dx} + 5y = 0$. [10]

b) Let $f(z) = z|z^2|$. Find all points in the complex plane where $f(z)$ satisfies C-R equations. Does $f(z)$ have a complex derivative at these points? [10]

- Q.7 a) Determine if and where the function $f(z) = z^2 \bar{z}$ is analytic? [10]

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 $z = i\frac{\pi}{2}$. [10]

- Q.8 a) Show that the Rodrigous' Formula satisfies the Legendre's Differential Equation. [10]

b) Using Laplace Transformation, solve IVP $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + y = 2te^{-t}$, [10]

$$y(0) = 1, y'(0) = 0.$$

- Q.9 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]



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M.A./M.Sc. Part – I Annual Exam – 2019

Subject: Space Science

Paper: II (Meteorology & Climatology)

Roll No.

Time: 3 Hrs. Marks: 100

**NOTE: Attempt any FIVE questions in all by selecting atleast TWO questions from each Section.
All questions carry equal marks.**

SECTION-I

- Q-1 (a) Explain the vertical structure of Atmosphere with respect to temperature and pressure. 10
(b) What is the composition of the atmosphere near the Earth's Surface? 10
- Q-2 (a) How the air temperature changes from the earth's surface to the lower thermosphere? 10
(b) Differentiate between absolute and relative humidity. 10
- Q-3 (a) Why does air pressure always decrease with increasing height above the surface? 10
(b) Explain how wind blows around low- and high-pressure areas in the Northern Hemisphere. 10
- Q-4 (a) What is a thunderstorm? 10
(b) Describe some of the features observed on a surface weather map. 10
- Q-5 Derive the Hydrostatic Equation and explain its applications. 20

P.T.O.

SECTION-II

Q-6 (a) How climatology is different from Meteorology? 10

(b) What are climate models? Also name any two climate models? 10

Q-7 Define the following 20

- Lithosphere
- Hydrosphere
- Cryosphere
- Biosphere

Q-8 How does the theory of plate tectonics explain climate change over periods of millions of years? 20

Q-9 What are the possible causes of climate changes? 20



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M.A./M.Sc. Part – I Annual Exam – 2019

Roll No.

Subject: Space Science

Paper: III (Astronomy)

Time: 3 Hrs. Marks: 100

NOTE: Attempt any FIVE questions in all selecting at least ONE question from each section.

SECTION – I

- Q.1. (a) What is light cone? State and explain its different regions by drawing its absolute Past, future and remote regions. (10)
(b) Discuss space-like, time-like and light-like congruences. (10)
- Q.2. (a) State and explain particles of zero rest mass with one example. (10)
(b) How mass and energy are related, explain it by using Einstein Explanation. (10)
- Q.3. (a) State and explain Doppler Effect, also discuss longitudinal and Transverse Doppler Effect. (10)
(b) Discuss consequences of Lorentz Transformation, length contraction and time dilation. (10)

SECTION – II

- Q.4. (a) Describe prime meridian, prime vertical, Azimuth, right ascension and declination, by drawing suitable diagrams. (10)
(b) 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)
- Q.5. (a) State and prove Kepler's Law for areal velocity? (10)
(b) State and explain the relationship between the mean Sun and apparent Sun. Discuss graphically this difference for the complete year. (10)

P.T.O.

- Q.6. (a) In a spherical triangle ABC if $b=103^{\circ}17'$, $c=27^{\circ}19'$ and $A=36^{\circ}15'$. Find A, B and C. (10)
- (b) Differentiate among declination latitude, right ascension and longitude by using suitable diagrams. (10)

SECTION – III

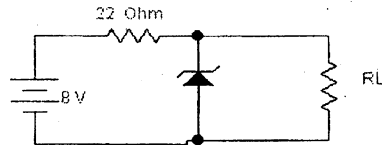
- Q.7. (a) What are Meteor, Meteorite, Meteoroid also explain their composition in detail (10)
- (b) Differentiate Asteroid and Kuiper Belt. (10)
- Q.8. (a) Discuss the characteristics of Jovian planets. (10)
- (b) Draw and label alpha stars of any two circumpolar constellations. (10)
- Q.9. Write a note on: (20)
- Red Planet
 - Theories of the origin of solar system



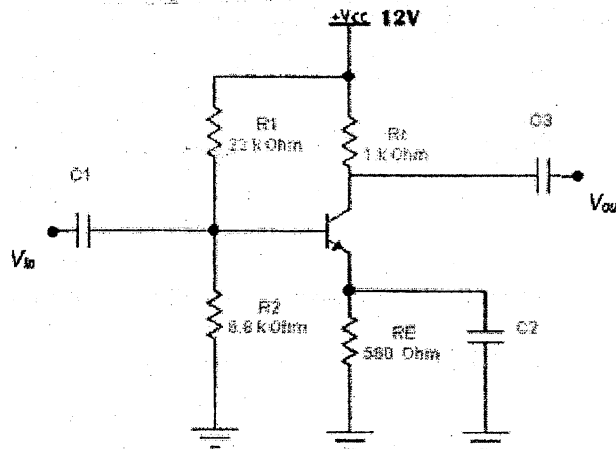
NOTE: Attempt any FIVE questions selecting at least TWO questions from each section. All questions carry equal marks.

Section I

1.
 - a) What is significance of majority charge carriers across the PN junction? Also explain the I-V curves for Si diode. (10)
 - b) Explain three diode models (approximations) (10)
2.
 - a) What are clampers? Explain clamping action. (10)
 - b) What is rectification. Explain full wave rectification using bridge rectifier circuit. If one diode out of four diodes, in a bridge rectifier circuit, is opened what will be the effect on the output waveform? (10)
3.
 - a) What is Zener break down voltage and explain its advantage. (10)
 - b) A loaded zener regulator is shown in figure. $V_z = 5.1V$ at $35mA$, $I_{ZK} = 1mA$, $Z_z = 12\Omega$, and $I_{ZM} = 70mA$. Determine the minimum and maximum permissible load currents. (10)



4.
 - a) What is load line for a transistor how you can draw it? What is Q point and discuss the effects of variations of Q point. (10)
 - b) Explain the fixed bias for the transistor and discuss its advantages and disadvantages? (10)
5.
 - a) Perform the ac analysis for common emitter amplifier. Also discuss how bypass capacitor effects the gain? (10)
 - b) Determine the signal voltage at the base of CE amplifier with $\beta_{ac} = 160$, $\beta_{DC} = 150$, $C_2 = 14.2\mu F$, $R_s = 100\Omega$ and $V_{in} = 10mV$ also calculate the base to collector voltage gain with and without bypass capacitor (10)



P.T.O.

section II

6.

a) What are the types of binary floating-point numbers? Convert the decimal number 3.248×10^4 to floating point binary number (Hint: Binary of 3.248×10^4 is 111111011100000) (10)

b) Perform the following: (10)

i) 5C2 (Hexadecimal to decimal)

ii) Subtraction of signed numbers in 2's complement format $01100101 - 11101000$

iii) 00010 (gray code to binary)

iv) 1001010 (binary to gray code)

v) Add following BCD numbers $0110\ 0111 + 0101\ 0011$

7.

a) Prove the universal property of NAND gate by constructing all other gates (AND, NOT, OR, NOR, XOR & XNOR) using NAND gate only (10)

b) State De Morgan's theorems and apply De Morgan's theorem to the simplification for the following expression: (10)

$$\overline{AB+CD+EF}$$

8.

a) What is Multiplexer and de multiplexer? Design and draw the circuit of 4-to-1- line MUX. (10)

b) Differentiate between S-R and J-K flip flops and draw its circuit diagrams. (10)

9.

a) Design 3-bit synchronous counter (10)

b) Write the difference between Asynchronous and Synchronous counter operation? Construct 4-bit synchronous decade counter. (10)



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Subject: Space Science

Paper: V (Remote Sensing & Image Processing)

Time: 3 Hrs. Marks: 100

NOTE: Attempt any FIVE questions. All question carry equal marks.

Draw diagrams where necessary.

- Q No.1** Define Electromagnetic Spectrum, and discuss the portions used in satellite remote sensing. Describe atmospheric scattering and discuss the phenomenon of variation of the color of sky from dawn to dusk in the context of atmospheric scattering. (2,4,4,10)
- Q No.2** What are the spectral response patterns? Draw and label, the spectral signatures of Soil and Vegetation and describe their responses in different portions of spectrum, from visible to Middle infrared range (4,16)
- Q No.3** What is the trichromatic color-theory? Define True and False Color composites Discuss in detail the cubical color model relating the Additive and Subtractive colors (5,5,10)
- Q No.4** What are different resolutions in Remote Sensing? Describe in detail, the Spatial and Spectral resolutions with examples of different sensors and the trade-off between the two resolutions (4,12,4)
- Q No.5** How different sensors in remote sensing are classified, based on source of illumination and mode of capturing data? Sketch and describe the working of an optical mechanical scanner (10,10)
- Q No.6** Why rectification is important and explain this process in detail for Image to map Rectification (4,16)
- Q No.7** Define the process of classification, its types and explain the process of Supervised classification using Maximum likelihood classifier (4,6,10)
- Q No.8** What are the two major types of Contrast Enhancements? Discuss percentage Linear contrast enhancement and Minimum-Maximum Stretch (4,8,8)
- Q No.9** Write Note on any two of the following
1) Visual Interpretation Key
2) OLI Sensor
3) ISODATA Classification (10,10)