



**NOTE: Attempt only FIVE questions in all by selecting at least TWO questions from each section. All questions carry equal marks.**

### SECTION I

1. (a) Explain the interaction of radiations with matter. (10 marks)  
(b) What are the spectroscopic binaria. (10 marks)
2. (a) Explain the birth of a star. (10 marks)  
(b) Explain different phases in the formation of variables stars. Also write their applications. (10 marks)
3. (a) Explain the formation of stellar red giants. (10 marks)  
(b) Write a note on the stellar evolution. (10 marks)
4. (a) Explain pair production and annihilation of pairs (10 marks)  
(b) Explain the phenomenon of gravitational collapse. Hence describe this process for neutron stars. (10 marks)

### SECTION II

5. (a) Estimate the age and life span of white dwarf. (10 marks)  
(b) Describe the history of cosmic evolution. (10 marks)
6. (a) Define luminosity. Explain the importance of integrated luminosity in order to study an event occurring with cross-section  $\sigma$  during the time of the experiment. (10 marks)  
(b) Write a note on the Black holes and gravastars. (10 marks)
7. (a) derive the fluid and acceleration equations. (10 marks)  
(b) What is role of dark energy in the accelerating expansion of the universe. Explain. (10 marks)
8. (a) Give details of Olber's paradox about the dark sky. (10 marks)  
(b) Provide a detailed explanation about inflationary era of the universe. (10 marks)
9. (a) Write a note on microwave background radiations . (10 marks)  
(b) Write a note on supernovae and its types. (10 marks)



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**SECTION –I**

- Q-1 Discuss four vector form of Maxwell’s equation and briefly describe the laws involved in Maxwell’s equation. 20
- Q.2. Discuss the solution of Maxwell’s equation for dielectric medium and characteristic of electromagnetic waves. 20
- Q.3 Define Intrinsic impedance and find the expression of intrinsic impedance when good conductors and good dielectric medium is involved. 20
- Q.4 a) State and proof Poynting theorem . 15
- b) In free space,  $E(z,t)= 550 \text{ Cos}(\omega t-\beta z) i^\wedge \text{ v/m}$  and  $H(z,t)= 6 \text{ Cos}(\omega t-\beta z) j^\wedge$   
Calculate average power. 5

**SECTION-II**

- Q.5 Discuss the behavior of charge particles in uniform electric and magnetic field and also discuss the significance. 20
- Q.6 Discuss the behaviors of charge particles in time varying magnetic field and also prove that magnetic moment is invariant in time varying field.
- Q.8. Discuss in detail the classical treatment of magnetic material and prove that it is not possible to consider plasma as magnetic medium. 20
- Q.9 Discuss briefly only two topics 10, 10
- a) Electron Plasma Oscillation b) Debye shielding c) Cutoff and Resonances for X-wave
- d) Dispersion relation for light Waves.



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### Section – I

- Q-1 (a)** Draw radiation pattern of a typical parabolic antenna? What is meant by 3-dB bandwidth? Explain. **10**
- (b)** A 9-m paraboloid reflector works with an illumination efficiency of 65 percent. Determine its gain at frequency of 6 GHz. **10**
- Q-2 (a)** Elaborate important parameters of Ionosphere. Signify their effects on communication. **10**
- (b)** Write detailed note on different propagation effects on mobile communication. **10**
- Q-3 (a)** What are different types of modulation schemes. Explain processes of PAM? **10**
- (b)** Elaborate frequency reuse techniques being used in recent communication systems? **10**
- Q-4 (a)** What are different coding schemes? Explain Differential Manchester Coding being applied in communication systems? **10**
- (b)** Draw and elaborate possible networks topologies. Is it possible to use them in VSAT applications? **10**

### Section – II

- Q-5(a)** Describe the TT&C facilities of a satellite communications systems. Are these facilities part of the space segment or part of the ground segment? **10**
- (b)** Briefly describe the equipment sections making up a transponder channel. **10**
- Q-6 (a)** The power output from a transmitter amplifier is 800 Watts. The feeder losses amount to 1 dB and the voltage reflection coefficient at the antenna is 0.01. Calculate radiated power. **10**
- Q-6 (b)** With the aid of a block schematic, describe the functioning of transmit-receive VSAT used for telephone traffic. **10**
- Q-7 (a)** In satellite link the propagation loss is 202dB. Margins and other losses are of 3 dB. The receiver G/T is 11 dB and the ERIP is 50 dBW. Calculate received C/N for a system bandwidth of 36 MHz. **10**
- (b)** An earth station is located at latitude 31.52 degree North and Longitude 74.35 degree West. Calculate the antenna look angles for a satellite at 38.2 degree East. **10**
- Q-8 (a)** Explain what is meant by input BO and output BO. What is the significance of input BO for operation of a satellite transponder. **10**
- (b)** Differentiate between bandwidth limited and power limited mode of transponder operation. What is preferred mode of operation? Justify. **10**
- Q-9** Write notes on any TWO of the following **10+10**
- Satellite Link-budget Analysis
  - Sun-transit Outage
  - Attitude and Orbit Control Subsystem (AOCS)
  - Ultra Satellite Aperture Terminal



# UNIVERSITY OF THE PUNJAB

**M.A./M.Sc. Part – II Annual Examination – 2022**

Roll No. ....

Subject: Space Science (New Course)  
Paper: IV (Space Systems and their Applications)

Time: 3 Hrs. Marks: 100

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

- Q-1 (a)** What is the logical concept of Critical Structural Phases of a satellite. **10**  
What are the different phases involved in it?
- (b)** What is the basic architecture of the system program of a satellite? **10**
- Q-2 (a)** What do you understand by Post-Launch Requirements of a **10**  
satellite?
- (b)** What are the different Orbital Elements. Give a brief description **10**  
of each of them?
- Q-3 (a)** Calculate the Satellite Period, Satellite Velocity and Satellite Position **10**  
while discussing the Satellite Path in space?
- (b)** How a satellite is launched and injected into its final orbit? **10**
- Q-4(a)** Discuss Telemetry Interface Function of a satellite? **10**
- (b)** How the communication traffic of a satellite is affected by sun's **10**  
interference?
- Q-5 (a)** Derive expressions to calculate the time period for umbra and **10**  
penumbra respectively for a satellite during an eclipse?
- (b)** What is the concept of bulk head and clustering in a Multi Stage **10**  
Rocket?
- Q-6** How a GPS works and calculates the position. How the timing **20**  
offset and multipath error is corrected in a GPS?
- Q-7 (a)** What is a satellite foot print. Discuss about different types of coverages **10**  
obtained by combining foot prints?
- (b)** Why is it important to estimate the overall mass of a satellite. How can **10**  
we calculate the dry and wet mass of a satellite?
- Q-8** Write in detail the overall working of Geosynchronous Meteorological **20**  
Satellite (GMS)?
- Q-9** Write notes on any TWO of the following **20**
- i. Propulsion Subsystem
  - ii. Space Probe
  - iii. Rocket Propellants

