UNIVERSITY OF THE PUNJAB

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

Roll No. .....

Subject: Space Science (New Course) **Paper: I (Astrophysics and Cosmology)** **Time: 3 Hrs.** **Marks: 100**

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

SECTION I

1. Explain the interaction of electromagnetic radiations with matter. Also define pair production and anihilation of pair. (20 marks)

2. During the interaction of X-rays with matter, the scattered X-rays show Compton's shift ($\Delta\lambda$) in wavelength. Derive a formula to calculate $\Delta\lambda$. (20 marks)

3. Explain the birth of a star. What are the sources of stellar energy in the universe. Derive the formula o calculate it. (20 marks)

4. Explain the existence of a "Black Holes" in the universe. (20 marks)

5. What are the final stages of universe. (20 marks)

P.T.O.

SECTION II

6. Explain the expansion of the universe, according to Big-Bang theory. (20 marks)

7. Explain and derive Kepler's second law of planetary motion. (20 marks)

8. Explain Hubble's law about the expansion of universe. How age of the universe can be determined. (20 marks)

9. What is a Hubble's constant. How it could be helpful to understand the evolution of our cosmos. from What are its units in modern cosmology. (20 marks)

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

Subject: Space Science (New Course)
Paper: II (Electrodynamics and Space Plasma)

Roll No. .....

Time: 3 Hrs. **Marks: 100**

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

SECTION –I

Q-1 Find the expression of electromagnetic field tensor and prove that any one Maxwell's equation is Lorentz Invariant. 15+5

Q.2. a) Prove that intrinsic impedance for non-conducting medium is 377ohms. 15

b) You are given Hz= 3xcosβ+ 7ySinα , If the electric field is invariant with time find the expression for current density. 5

Q.3 Find the solution of electromagnetic waves in conducting medium and the characteristics involved in the solution. 20

Q.4 a) What is Poynting vector? Discuss the concept of Instantaneous Power, average power and complex power. 15

b) In free space, **E (z,t)**= 700 Cos(ωt-βz) i^ v/m and **H (z,t)**= 4.55 Cos (ωt-βz) j^

Calculate average power. 5

P.T.O.

SECTION-II

Q.5 a) Define Plasma and also discuss concept of temperature in plasma. 5

b) Explain Debye Shielding and prove that Debye length depends upon density of plasma and temperature of the plasma. 15

Q.7. Prove that drift velocity in varying electric field is given by 20

$$V_E = \frac{E \times B}{B^2} \left(1 - \kappa^2 r_L^2 / 4\right)$$ where κ is wave vector and r_L is Larmour radius.

Q.8. Discuss in detail the classical treatment of dielectric material and calculate the value of dielectric for a plasma. 20

Q.9 Discuss briefly only two topics 10, 10

a) Electron Plasma Oscillation **b)** Sound waves in plasma **c)** Cutoff and Resonances for **X**-wave

d) Drift velocity due to curved **B** field.

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

Roll No. .....

Subject: Space Science (New Course) **Time: 3 Hrs.** **Marks: 100**

Paper: III (Telecommunication and Satellite Communication)

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

SECTION-I

No.	Question	Marks
1 (a)	What are the advantages of Encoding?	5
1 (b)	Define AM modulation process with pure tones. What is percentage modulation? Mathematically prove that information amplitude is distributed equally in sidebands?	5
1 (c)	What are high and low level A.M modulators and explain one modulator of each type?	1+4
1 (d)	A transmitter radiates 9 kW with un-modulated carrier and 10.125 kW with sinusoidal AM modulated carrier. Calculate (i) Modulation index (ii) Percentage of modulation	2.5+2.5
2 (a)	Define transmission line. What are balanced and un-balanced transmission lines?	2+2+2
2 (b)	Define characteristic impedance, standing wave ratio (SWR) and reflection coefficient?	3+3+3
2 (c)	Find characteristics impedance for coaxial cable if shield's inner diameter is 0.2 inches and center conductor has diameter of 0.087 inches?	5
3 (a)	Write note on following parameters of ionosphere? i- Virtual height ii- Critical Frequency iii- Critical angle iv- Maximum usable frequency (MUF) v- Skip distance	10
3 (b)	What are diffraction zones and how communication is possible in these zones?	4
3 (c)	A receiver antenna located at 80 km from the transmitting. The height of the transmitting antenna is 100 m. What is the required height of the receiver antenna?	6
4 (a)	Define types of Pulse Modulation. Explain the processes of Pulse Amplitude Modulation (PAM).	4+6
4 (b)	What are the errors of PCM and how they could be minimized?	5
4 (c)	If a voice signal is sampled at Nyquist's rate and quantized at 512 levels. Calculate the data rate to transmit it.	5

P.T.O.

SECTION-II

No.	Question	Marks
5 (a)	State advantages and disadvantages of satellite communications over optical fibre communications.	6
5 (b)	Write note on classical orbital elements.	8
5 (c)	A satellite is in a circular orbit around the earth. The altitude of the satellite's orbit above the surface of the earth is 1,400 km. (iv) What are the centripetal and centrifugal accelerations acting on the satellite in its orbit? (v) What is the velocity of the satellite in this orbit? (vi) What is the orbital period of the satellite in this orbit?	6
6 (a)	Write a note on satellite services.	2
6 (b)	Derive satellite link equation and comment on it? Write frequency bands suitable for satellite communications.	4+4
6 (c)	State following satellite link performance parameters: i) Equivalent noise temperature ii) Carrier-to-Noise Density Ratio (C/N_o) iii) Noise factor iv) EIRP v) Back off loss	10
7 (a)	What are satellite link design objectives?	5
7 (b)	What are major factors of propagation losses for satellite link?	5
7 (c)	Consider a satellite transmitting 25 watts at a frequency of 4GHz via an antenna of 18dB gain at 40,000 km from earth station. An earth station in the network uses an antenna of 12m diameter with an efficiency of 65%. Determine i) The gain of earth station antenna ii) Path Loss iii) The flux density at the earth station iv) The power received at the output of the earth station antenna	10
8 (a)	Explain Telemetry, Tracking and Command Sub-system (TT&C) of satellites.	6
8 (b)	Explain satellite tracking techniques.	7
8 (c)	Draw block diagram of Attitude and Orbital Control Sub-system (AOCS) of Satellite.	7
9	Write note on two topics from following; 5- Encoding techniques 6- Multiplexing 7- Satellite system topologies 8- Earth station	10+10

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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 are the different phases in construction of an earth segment. Discuss about the ground support facilities in it?	10
(b)	Give an overview of Aerospace System and discuss the role of Aerospace Management in an Aerospace Industry?	10
Q-2 (a)	Describe the concept of an OPERATIONAL ORGANIZATION for a Communication satellite?	10
(b)	State and prove KEPLER's Third law?	10
Q-3 (a)	How a satellite is effected by SUN's INTERFERENCE. How we can calculate the timing of Sun's Interference?	10

P.T.O.

(b)	What is Range Rate method. How we can calculate the distance between the satellite and TT&C station using PHASE DIFFERENCE Technique?	10
Q-4(a)	Calculate the SATELLITE PERIOD, SATELLITE VELOCITY and SATELLITE POSITION while discussing the Satellite Path in Space?	10
(b)	Write a complete note on GEOSTATIONARY ORBIT. What is its significance for a communication satellite?	10
Q-5 (a)	Derive expressions to calculate the time period for UMBRA and PENUMBRA respectively for a SATELLITE during an ECLIPSE?	10
(b)	Briefly discuss the working various types of LAUNCH VEHICLES?	10
Q-6 (a)	How a RELIABILITY MODEL of a communication is calculated?	10
(b)	Briefly discuss the RECENT DEVELOPMENTS IN SPACE SYSTEMS of Pakistan?	10
Q-7 (a)	Discuss all the scientific procedure in making of PAKSAT 1R?	10
(b)	How a SPACE SHUTTLE is launched sequentially?	10
Q-8	Write in detail the overall working of METEOSAT Meteorological Satellite?	20
Q-9	**Write notes on any TWO of the following** (10 + 10) =	20

i. Satellite Orbits
ii. Space Probe
iii. Solar Radiation Pressure (SRP)

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Roll No. .....

Subject: Space Science (New Course) **Paper: V (Geographic Information System)** **Time: 3 Hrs.** **Marks: 100**

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

Draw diagrams where necessary.

1. Explain the methods of VECTORIZATION and RASTERIZATION. Also write down RUN LENGTH ENCODING and QUAD TREE methods for Data Compression. (5,15)

2. What is Land Tenure System and Land Registration process? Explain Khasra Number., Mouza, Patwar circle , Qanoon Goi, Mussavie and Latha. (8,12)

3. How GIS can help in Urban Planning in Pakistan? What is the role of Enterprise GIS in urban planning and Management? (10,10)

4. What are raster and vector Data Models. What are the advantages and disadvantages of each model? What is data capture in GIS? Discuss characteristic of a good aerial camera. (5,5,5,5)

5. Explain DATUM and GEOID. Discuss OVERLAY ANALYSIS in GIS. Explain in detail various functions involved to perform the operation. (8,12)

P.T.O.

6. What is the principle of Photogrammetry? What is meant by aero triangulation? Explain the concepts of photographic measurement and refinement? (5,5,10)

7. Explain the key concepts of GIS Network Analysis? How transportation Networks, Stream Networks and Utility Networks of Pakistan can benefit from GIS based Network Analysis? (5,15)

8. Discuss GPS data in terms of COMPOSITION, FRAME FORMAT and Timing of Transmission including GPS Navigation data. Write a detail note on DIFFERENTIAL GPS. (10,10)

9. Write a comprehensive note in TWO of the followings: (10,10)
   (a) Advantages of GIS and limitations of GIS
   (b) PERTURBATIONS to the GPS signals
   (c) MAP SCALE
   (d) TOPOLOGY and Spatial and Non Spatial Data