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5 SEM TDC DSE PHY (CBCS)
2 (H) A/B/C

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(November)

PHYSICS

(Discipline Specific Elective)

(For Honours)

Paper : DSE-2

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

Paper : DSE-2 (A)

(Astronomy and Astrophysics)

Full Marks : 80
Pass Marks : 32

1. Choose the correct answer from the following : 1×8=8

(a) The relation between parsec (pc) and astronomical unit (AU) is

(i) $1 \text{ Mpc} = 206265 \text{ AU}$

(ii) $1 \text{ Mpc} = 206265 \times 10^6 \text{ AU}$

(iii) $1 \text{ pc} = 2062.65 \text{ AU}$

(iv) $1 \text{ kpc} = 206265 \text{ AU}$

(b) The luminosity of a star is related to its effective surface temperature as

(i) $L \propto T_{\text{eff}}$

(ii) $L \propto T_{\text{eff}}^2$

(iii) $L \propto T_{\text{eff}}^4$

(iv) $L \propto T_{\text{eff}}^6$

(c) On the celestial sphere, the north pole has a declination of

(i) π

(ii) $+\frac{\pi}{2}$

(iii) $-\frac{\pi}{2}$

(iv) 0

(d) The mass-luminosity relation is given by

(i) $L \propto M$

(ii) $L \propto M^2$

(iii) $L \propto M^{\frac{1}{2}}$

(iv) $L \propto M^3$

(e) Newtonian telescope used in astronomy is a

(i) reflecting telescope

(ii) refracting telescope

(iii) dispersive telescope

(iv) None of the above

(f) From the solar system, the galactic centre is situated at a distance of about

(i) 1 Mpc

(ii) 8 kpc

(iii) 1 AU

(iv) 1 kpc

(g) Andromeda Galaxy belongs to a galaxy of type

(i) elliptical

(ii) circular

(iii) spiral

(iv) irregular

(h) According to Harvard spectral classification, with decreasing temperature towards the right, the sequence is

(i) A-B-F-G-K-M-O

(ii) O-B-A-F-G-K-M

(iii) O-B-A-K-M-F-G

(iv) B-A-F-G-O-K-M

(4)

2. (a) Define apparent and absolute magnitudes of a star and derive an expression for the distance modulus.

2+4=6

Or

Describe the trigonometric parallax method for measuring distance of stars. Can the distances of all stars be measured by this method? Why? 4+1+1=6

- (b) The apparent magnitude of the sun is -26.8 . Determine its absolute magnitude. It is given that the distance between the sun and the earth is 1.5×10^{11} m.

3

Or

Define luminosity and the radiant flux.

$1\frac{1}{2} + 1\frac{1}{2} = 3$

- (c) Explain the direct method of determining the radii of stars.

3

Or

The distance modulus of the star Vega is -0.5 . What is its distance from us?

- (d) Using Stefan-Boltzmann law of radiation, obtain the ratio of radii R_1 and R_2 of two stars with surface temperatures T_1 and T_2 and of absolute magnitudes M_1 and M_2 , respectively.

5

(Continued)

(5)

Or

The α Centauri binary system is 1.338 pc distant with a period of 79.92 years. The A and B components have a mean separation of 23.7 AU. What is the total mass of the system? If primary component, α Centauri A has a mean distance of 11.2 AU from the system's barycenter, what is the mass of each of the component stars in the system?

- (e) Draw the celestial sphere showing the celestial poles, celestial equator, ecliptic, vernal equinox and autumnal equinox.

5

3. (a) Explain the horizon coordinate system with proper diagram. Discuss the shortcomings of this system.

4+2=6

- (b) What are light gathering power, resolving power and diffraction limit of an optical telescope? Calculate the diffraction limit of resolution of a 3 m telescope for the wavelength of 600 nm.

2+2+2+2=8

4. (a) Draw a schematic diagram showing the layers of solar atmosphere.

4

(Turn Over)

(6)

- (b) Write a short note on any one of the following : 3
- (i) Solar activity
 - (ii) Extra solar planet
5. (a) Draw a labelled *H-R* diagram and explain its significant features. 3+2=5
- (b) Draw blackbody radiation curves for three objects with mean temperatures T_1 , T_2 and T_3 respectively, such that $T_1 > T_2 > T_3$. 3
6. Answer any three questions from the following : 5×3=15
- (a) Make a sketch of the Milky Way Galaxy and label its various components. Show the position of the sun in it. 4+1=5
 - (b) With an appropriate diagram, explain Hubble's classification of galaxies. What is the type assigned to the Milky Way Galaxy? 4+1=5
 - (c) Distinguish between spiral and elliptical galaxies giving one example of each type. 5
 - (d) Draw the galaxy rotation curve. Describe how it can give an evidence of presence of dark matter. 2+3=5

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(Continued)

(7)

7. (a) State Hubble's law. Given that the value of the Hubble constant is $70 \text{ kms}^{-1} \text{ Mpc}^{-1}$, estimate the age of the universe. 1+5=6

Or

- (b) Discuss the concept of cosmic ladder. Explain how Cepheid variables stars have been used for measuring distances of nearby galaxies. 2+4=6

Paper : DSE-2 (B)

(Physics of Devices and Instruments)

Full Marks : 53

Pass Marks : 21

1. Choose the correct answer from the following : 1×5=5
- (a) A unijunction transistor has
 - (i) two *p-n* junctions
 - (ii) one *p-n* junction
 - (iii) three *p-n* junctions
 - (iv) None of the above

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(Turn Over)

- (b) In a P-channel JFET, the charge carriers are
- electrons
 - holes
 - both electrons and holes
 - protons
- (c) Which of the following filter circuits results in the best voltage regulation?
- Chock input
 - Capacitor input
 - Resistance input
 - None of the above
- (d) A Class 10 clean room can have
- 35 dust particles per m^3
 - 350 dust particles per m^3
 - 3500 dust particles per m^3
 - 10 dust particles per m^3
- (e) Electronic-Grade Silicon (EGS) is
- polycrystalline material
 - single-crystal material
 - amorphous material
 - monocrystalline material

2. Discuss the construction and working of a unijunction transistor (UJT). Name some of its important applications. 3+1=4

Or

Discuss the construction and working of a JFET. Mention its advantages. 4

3. Write short notes on any two of the following : 3×2=6

- Depletion-mode MOSFETS
- MOS device
- Tunnel diode

4. (a) What is the need of filter circuit? Describe qualitatively the action of L filter. 1+3=4

Or

Give a comparison between active and passive filters with examples of each type. 4

- (b) Explain the working of an astable multivibrator with a circuit diagram. 4

5. The intrinsic stand off ratio for a UJT is determined to be 0.6. If the inter-base resistance is $5\text{ k}\Omega$, what are the values of RB_1 and RB_2 ? 2

(10)

6. Draw the basic Phase-locked Loop (PLL) configuration. What are the purposes of loop filter in PLL? 2+2=4

7. (a) Why is wet etching process anisotropic? Mention the challenges related to etching process. 1+2=3

Or

Define the three parameters, which determine the performance of a lithographic exposure. 3

(b) Discuss different types of layering steps. 3

Or

Discuss briefly chemical vapour deposition method with its advantages.

8. Write notes on any two of the following : 2×2=4

(a) Photoresists

(b) Projection printing

(c) Shadow printing

(d) Electron lithography

9. Write the full form of RS-232. Which wires do the symbols 'Tx' and 'Rx' mean? 1+1=2

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(Continued)

(11)

10. What are the features/advantages of GPIB? 2

11. Draw the circuit diagram of CE amplitude modulator. 2

12. What do you mean by amplitude modulation? Mention its different types and discuss briefly any one of it. 1+2+2=5

13. What is modulation index? Give its physical significance. 1+2=3

Paper : DSE-2 (C)

(Physics of Earth)

Full Marks : 80

Pass Marks : 32

1. Choose the correct answer/Fill in the blank from the following (any eight) : 1×8=8

(a) The solar system is located ____ of the Milky Way Galaxy.

(i) at the centre

(ii) in a spiral arm

(iii) at elliptic plane

(iv) at the edge

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(Turn Over)

- (b) The ice sheets of Greenland and Antarctica, continental glaciers and snowfields, sea ice and permafrost form the
- (i) biosphere
 - (ii) geosphere
 - (iii) hydrosphere
 - (iv) cryosphere
- (c) Volcanism is the process happening in the
- (i) geosphere
 - (ii) atmosphere
 - (iii) biosphere
 - (iv) cryosphere
- (d) In the stratosphere, the temperature increases with height due to the presence of
- (i) ozone layer
 - (ii) ozone hole
 - (iii) less amount of gases
 - (iv) sulfuric acid droplets
- (e) The frequency of the cosmic microwave background radiation falls in the _____ range of the electromagnetic spectrum.
- (i) visible
 - (ii) infrared
 - (iii) microwave
 - (iv) radio frequency

- (f) Earthquakes can occur with _____ faulting.
- (i) normal
 - (ii) reverse
 - (iii) thrust
 - (iv) All of the above
- (g) Which of the following describes the build-up and release of stress during an earthquake?
- (i) Modified Mercalli scale
 - (ii) Principle of superposition
 - (iii) Elastic-rebound theory
 - (iv) Travel time difference
- (h) The point where movement occurred and which triggered the earthquake is the
- (i) dip
 - (ii) epicenter
 - (iii) focus
 - (iv) strike
- (i) The present-day climate change is due to the
- (i) change in earth's orbital parameters
 - (ii) solar activity
 - (iii) human activity
 - (iv) ozone hole

- (j) The global warming is due to the
- (i) natural greenhouse effect
 - (ii) enhanced greenhouse effect
 - (iii) runaway greenhouse effect
 - (iv) climate change

2. Answer the following questions :

- (a) What is a meteoroid? State the difference between a meteor and a meteorite. 1+2=3
- (b) State the differences between the terrestrial and Jovian planets. Why are they so named? 3+1=4
- (c) Which planetary bodies in the solar system exhibit resemblance with the earth? Explain. 4
- (d) What is cosmic microwave background radiation? Explain its relation with the origin of the universe. 1+4=5

Or

Discuss the different stages of the formation of a star. 5

3. Answer the following questions :

- (a) Discuss the interaction between the different spheres and the solid earth. 5

- (b) Explain how the glacier ice sheets and polar ice caps influence the earth's ecosystem. 3
- (c) Name different layers of the earth's atmosphere. Discuss the variation of temperature with altitude. What constitutes the earth's atmosphere? 2+3+2=7
- (d) Discuss the variation of pressure and density of the earth's atmosphere with altitude. 5

Or

Explain the components of the biosphere.

4. Answer the following questions :

- (a) Distinguish between earthquake magnitude and intensity. Discuss various earthquake magnitude scales. 1+3=4
- (b) What are faults? Discuss the different types of faults responsible for causing earthquakes. 1+2=3
- (c) What are seismic waves? Discuss the different types of seismic waves and their characteristics that distinguish one from the other. 1+4=5

Or

- (d) What are earthquakes? Discuss the different types of earthquakes based on their mode of origin. 1+4=5

5. Answer the following questions :

- (a) Discuss the timeline of major geological and biological events of the earth. 1+4=5

Or

Discuss the role of the biosphere in shaping the environment. 5

- (b) Discuss the future evolution of the earth and the solar system. 5

6. Answer any *two* of the following questions :

7×2=14

- (a) Explain the role of Milankovitch cycle on paleoclimate change. Is this affecting the present-day climate change? Explain.
- (b) Explain how human activity is affecting the environment.
- (c) Explain water cycle. How does it help in maintaining a steady state?

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