

K16P 0207

Reg. No.

Name

Fourth Semester M.Sc. Degree (Regular/Supplementary/Improvement)
Examination, March 2016
PHYSICS (2014 Admn.)
PHY 4C14 : Optics

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer both questions (either a or b).

1. a) With the help of a diagram explain the working of a carbondioxide laser.

OR

- b) i) Explain the nonlinearity in the polarization of the medium
ii) Derive the equation for the generation of second harmonics.

2. a) i) Explain the structure and theory of propagation of light in an optical fibre.

- ii) Write a short note on the signal degradation in fibres.

OR

- b) Discuss the different types of signal distortions in an optical fibre.

(2×12=24)

SECTION – B

Answer any four. (One mark for Part – a, 3 marks for Part – b, 5 marks for Part – c)

3. a) What do you mean by temporal coherence ?

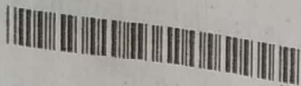
- b) Explain the rate equation for a four level laser system.

- c) At what temperatures are the rates of spontaneous and stimulated emission equal. Take $\lambda = 500 \text{ nm}$.

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4. a) What is Kerr effect ?
b) Write a note on optical rectification.
c) Distinguish between Type 1 and Type 2 phase matching.
5. a) Define numerical aperture.
b) Calculate the temporal broadening of an impulse after propagating through 1 km in a graded index fibre if refractive index of core is 1.4746 and that of cladding is 1.46.
c) Explain the characteristics of optical fibre amplifier.
6. a) Define quality factor of a laser.
b) Write down any three applications of He-Ne laser.
c) Derive the Einstein's coefficients and explain its significance.
7. a) What is Pockels effect ?
b) Write a note on stimulated Raman Scattering.
c) A step index of single mode fibre exhibits material dispersion of $6 \text{ ps nm}^{-1} \text{ km}^{-1}$ at an operating wavelength of $1.55 \mu\text{m}$. Assume that $n_1 = 1.45$ and $\Delta = 0.5\%$, calculate the diameter of the core needed to take the total dispersion of the fibre zero at this wavelength.
8. a) Define frequency mixing.
b) With the help of energy level diagram explain the working of a Ruby laser.
c) What are the different types of line broadening mechanisms in laser ?

(4x9 = 36)



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PHYSICS

PHY4C15 : Numerical Technique and Probability

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer any two :

1. a) What do you understand by Chi-square distribution ? Discuss the Chi-square test of goodness of fit of a theoretical distribution to an observed frequency distribution.

OR

- b) Explain with theory Newton-Raphson method. Obtain the convergence. What are the limitations of this method ?

2. a) Elucidate the Simpson's one third rule and 3/8 rules for numerical integration.

OR

- b) i) Obtain the Euler's method of finding an approximate solution of a differential equation.

- ii) Use Runge-Kutta method of the fourth order to find $y(0.1)$, given that

$$\frac{dy}{dx} = \frac{1}{(x+y)}, y(0) = 1.$$

(2×12=24)

SECTION – B

Answer any four. 1 mark for Part a), 3 marks for Part b), 5 marks for Part c).

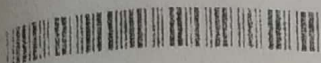
3. a) What is the chance that a non-leap year should have fifty-three Sundays ?
b) State and prove multiplication theorem of probability.
c) Calculate the probability of picking a card that was a heart or a spade. Comment on your answer.

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4. a) What is Normal distribution ?
b) Define Poisson Distribution and state the conditions under which this distribution is used.
c) Consider a simple trial of tossing a perfectly round and balanced coin six times. Then the probability of getting (i) exactly three heads (ii) at least three heads (iii) not more than two heads.
5. a) What is transcendental equation ? Give examples.
b) Give an account on Regula-Falsi method of finding the real root of an equation.
c) Find a root of the equation $x^3 - 4x - 9 = 0$, using the bisection method correct to - three decimal places.
6. a) Why is Trapezoidal rule so called ?
b) Write a short note on forward and backward differences.
c) Briefly explain the error propagation in a difference table.
7. a) What do you mean by linear interpolation ?
b) Obtain Newton's forward interpolation formula for equal intervals.
c) Use Lagrange's interpolation formula to find the value of y at $x = 6$ from the following data :
- | | | | | |
|-----|-----|-----|----|----|
| x | 3 | 7 | 9 | 10 |
| y | 168 | 120 | 72 | 63 |
8. a) What is curve fitting ?
b) Briefly explain Milne's method, to find a solution of the differential equation.
c) Using Euler's method to solve $\frac{dy}{dx} = 1 + xy$ with $y(0) = 2$. Find $y(0.1)$, $y(0.2)$ and $y(0.3)$.
- (4×9=36)



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Fourth Semester M.Sc. Degree (Regular/Supplementary/Improvement)
Examination, March 2016
PHYSICS (2014 Admn.)
PHY 4E07 : Astrophysics

Time : 3 Hours

Max. Marks : 60

SECTION - A

Answer both questions (either a or b).

1. a) Describe how Saha's work of the ionization theory ushered in a breakthrough in the understanding of the puzzling variety of stellar spectrum. What were the earlier interpretations?

OR

- b) Write down the basic equilibrium conditions that must be satisfied by a stable stellar structure and derive the condition of radiative equilibrium.

2. a) What is Spectroscopic binary? Discuss eclipsing binary and the light curve of eclipsing binary with diagrams. Write a note on typical eclipsing binaries.

OR

- b) Discuss the morphological classification of normal galaxies. (2×12 = 24 Marks)

SECTION - B

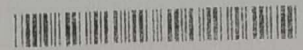
Answer any four. (One mark for part a, 3 marks for part b, 5 marks for part c).

3. a) Define parsec.

- b) Define apparent and absolute magnitude of a star and establish a relation between them.

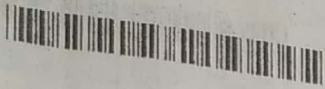
- c) The apparent magnitude of a star is observed to be +3.3 and its parallax is 0.025. Find the absolute magnitude of the star. Compare the luminosity of this star with that of the sun ($M_{\text{sun}} = +5$)

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4. a) What are Fraunhofer lines ?
b) What is H-R diagram ? Give its importance.
c) Draw a neat sketch of the HR diagram showing the position of (a) the main sequence stars with the Sun (b) the blue and the red supergiant stars (c) the white dwarfs.
5. a) Which are the two nuclear reactions taking place inside a star ?
b) Write a note on white dwarfs.
c) Consider the following stars composed entirely of hydrogen :
i) $M = 100 M_{\odot}$, $L = 10^6 L_{\odot}$ ii) $M = 10 M_{\odot}$, $L = 4 \times 10^3 L_{\odot}$.
If all these stars convert hydrogen to helium, calculate the periods over which they will shine.
6. a) Name the two class of binary stars.
b) Discuss the Band structure of semiconductors.
c) The period of a visual binary is 100 years. Its parallax is $0''.15$ and its semimajor axis is $5''$. Compute the total mass of the system.
7. a) What are QUASARS ?
b) Discuss the evolution of cluster of galaxies.
c) Write a note on Gamma Ray Bursts.
8. a) What is redshift ?
b) Give the general theory of relativity
c) Discuss the Friedmann cosmological model.

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K16P 0211

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(2014 Admn.)

PHYSICS

PHY 4E08 : Electronic Instrumentation

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer **both** questions (either **a** or **b**) :

1. a) Draw the basic block diagram of an oscilloscope and explain the functions of each block. Draw and explain the electrostatic focusing of a CRT.

OR

- b) Explain with necessary figures the construction details and working of :

- 1) LVDT transducer
- 2) Variable reluctance type transducer.

2. a) Explain with circuit diagram the working of an electric strain gauge using potentiometer circuit. (Ballast circuit) Obtain the expression for voltage sensitivity.

OR

- b) Explain with circuit diagram, voltage and current waveforms the working of a single phase full bridge inverter. (2×12=24)

SECTION – B

Answer **any four**. 1 mark for part **a**, 3 marks for part **b**, 5 marks for part **c**.

3. a) Define accuracy.
- b) Explain the least square linearity.
- c) For the given finite data, calculate the standard deviation.
 $X_1 = 49.7$ $X_2 = 50.1$ $X_3 = 50.2$ $X_4 = 49.6$ $X_5 = 49.7$

P.T.O.



4. a) Define deflection sensitivity.
b) Explain with the aid of block diagram the vertical section of the deflection system of an oscilloscope.
c) How much voltage is required across two deflection plates separated by 1 cm to deflect an electron beam 1° . If the effective length of the deflection plates is 2 cm and the accelerating potential is 1000 V.
5. a) What do you mean by a transducer ?
b) Explain digital transducer.
c) The maximum output of an LVDT is 5.2 V. The range of the position of the core is ± 0.5 cm. Calculate the output voltage when the core is $+0.45$ cm from the centre.
6. a) What is the principle of operation of a semiconductor strain gauge ?
b) Explain any two wire gauges.
c) A resistance strain gauge with a gauge factor 2.4 is mounted on a steel beam whose modulus of elasticity is 2×10^6 kg/cm². The strain gauge has an unstrained resistance of 120.0Ω which increases to 120.1Ω when the beam is subjected to a stress. Calculate the stress at the point where the strain gauge is mounted.
7. a) What is turn on time of a thyristor ?
b) Explain spread time t_p of a thyristor.
c) The trigger circuit of a thyristor has a source voltage of 15 V and the load line has a slope of -120 VA^{-1} . The minimum gate current to turn on the SCR is 25 mA. Compute :
 - a) The source resistance required in the gate circuit
 - b) Trigger voltage for an average gate power dissipation of 0.4 W.
8. a) Name any two electrodes used for measuring ECG.
b) Briefly describe electroencephalograph.
c) Explain with the aid of block diagram the working of a cardiac pace maker.

(4×9=36)