

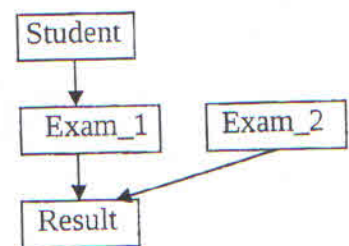
Q. P. Code : 529004

(3 Hours)

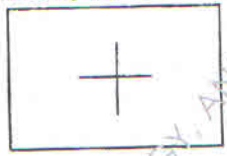
Total Marks: 100

N.B.: (1) Question No. 1 is compulsory.
(2) Attempt any four questions out of remaining six questions.

1. (a) Explain how Java is platform independent. 10
(b) What is command line argument? Write a program in java to find largest of three numbers accepted from command line. 10
2. (a) Explain the different types of inheritances supported in Java. 10
(b) Write a program using interfaces for the given hierarchy 10



3. (a) Explain exception handling in java with example. 10
(b) What is vector? How it is different from an array? 10
4. (a) Explain life cycle of a thread. 10
(b) Write a program in java to find factorial of a given number. 10
5. (a) Explain the concept of thread synchronization. 10
(b) Write an applet to display the following 10



6. (a) What are constructors? Explain different types of constructors with example. 10
(b) Write a program in Java to check whether the given string is palindrome or not. 10
7. Write short note on (any two) 20
 - a. Call by value and call by reference
 - b. Wrapper class
 - c. Access protection in Java
 - d. Life cycle of an applet

- N.B. :** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions out of the remaining **six**.
 (3) **Figures** to the **right** indicate **full marks**.
 (4) Atomic weights : C = 12, H = 1, N = 14, O = 16, Na = 23, Mg = 24, S = 32, Cl = 35.5, Ca = 40, Ba = 137.5.

1. Answer any **five** from the following :-

15

- A coal sample was subjected to ultimate analysis, 0.4gm of coal on combustion in a Bomb calorimeter produces 0.03 gm BaSO₄. Calculate the percentage of sulphur in coal sample.
 - Write a short note on super critical CO₂ as a green solvent.
 - Write the difference between galvanizing and tinning.
 - Write the classification of composite materials.
 - Write a short note on zeolite as a catalyst.
 - Write the composition, properties and uses of Duralumin.
- (a) What is cracking ? Explain fluid bed catalytic cracking with the help of neat diagram. 6
 - (b) Define corrosion. Explain stress corrosion with appropriate diagram and example. 5
 - (c) Calculate the percentage atom economy of the following reaction with respect to allyl chloride. 4



- (a) Calculate the weight and volume of air required for complete combustion of 1 kg of coal containing :- C = 62%, H = 4%, O = 6%, N = 2% and remaining being ash. (Mol. wt. of air = 28.949) 6
- (b) Explain particles reinforced composite materials. 5
- (c) How these factors influence the rate of corrosion. 4
 - Overvoltage
 - pH of the medium.
- (a) What is catalysis ? Explain the adsorption theory of catalysis. 6
- (b) Explain the sacrificial anodic protection method of corrosion control 5
- (c) Write the manufacture and properties of Al₂O₃ ceramics. 4

[TURN OVER

5. (a) Explain the production of adipic acid with conventional and green route. 6
- (b) A sample of coal has the following composition by mass C = 78%, H = 5%, O = 9%, S = 0.6% and remaining being nitrogen. Calculate H.C.V. and L.C.V. of coal using Dulong's formula. 5
- (c) Explain the powder injection moulding method for compacting in powder metallurgy. 4
6. (a) Write the constituents of paint with examples and explain their functions. 6
- (b) Write any five purposes of making alloys. 5
- (c) What is knocking ? Explain the reason of petrol knocking. 4
7. (a) Write the transesterification reaction of production of bio-diesel. What are the advantages of bio-diesel. 6
- (b) Define and explain activation energy. 5
- (c) Give the functions of matrix phase in composite material with their properties. 4

Sem-II (FE old)
Applied Physics.

17/5/16.

QP Code : **28544**

(2 Hours)

[Total Marks :75

- N.B. : (1) Question no. 1 is compulsory.
(2) Attempt any four questions from the remaining.
(3) Assume suitable data and symbol-if required.
(4) Figures to the right indicate full marks.
(5) Illustrate your answer with sketches wherever necessary.

1. Solve any five from the following:-

- (a) What is Rayleigh's criterion for resolution? Write an expression for the resolving power of a grating? 15
(b) Newton's rings are observed in reflected light of wavelength 5×10^{-5} cm. The diameter of 10th dark ring is 0.5 cm. Calculate the radius of curvature R and thickness of the film t at the ring.
(c) Differentiate between stimulated and spontaneous emission.
(d) Why electron microscope is considered better than optical microscope.
(e) Calculate the numerical aperture and hence the acceptance angle for an optical fibre whose core R.I. 1.48 and a cladding R.I. of 1.39.
(f) Calculate de Broglie wavelength of proton with a velocity equal to $1/20$ th velocity of light. Given: $m_p = 1.6 \times 10^{-27}$ kg and $h = 6.63 \times 10^{-34}$ J.sec
(g) Write the relation between relative permeability and susceptibility.

2. (a) Show that in Newton's ring, diameter of the bright ring is proportional to the square root of the odd natural number. Find out similarities and dissimilarities between Newton's rings and Wedge shaped film. 8

(b) Consider an air cored torroid with 500 turns with cross sectional area of 6 cm², mean radius of 15 cm and coil current of 4 Amp, Now calculate MMF(NI), Reluctance (R), Magnetic flux, Magnetic flux density, Magnetic flux intensity. 7

3. (a) What is de Broglie's concept of matter waves? Derive one dimensional time dependent Schrodinger wave equation for matter waves. 8

(b) White light is incident on a soap film at an angle $\sin^{-1}(4/5)$ and the reflected light observed with a spectroscope. It is found that two consecutive dark bands correspond to wavelengths 6.1×10^{-5} and 6.0×10^{-5} cm. If the refractive index of the film be $4/3$, calculate the thickness. 7

4. (a) What is monomode, multimode fibre? Differentiate between step index and graded index fibre. 5

(b) Explain with the diagram, the construction and working of semiconductor diode laser. 5

(c) An electron is confined in a box of length 10^{-8} m. Calculate minimum uncertainty in its velocity. 5

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5. (a) In a plane transmission grating with 5000 lines/cm and for a wavelength of 6000 Å, if the width of opaque spaces are exactly twice that of transparent spaces, which order of spectra will be absent? 5
- (b) In Newton's ring experiment, if the n^{th} dark ring due to wavelength λ_1 coincides with $(n+2)^{\text{th}}$ dark ring due to wavelength λ_2 , prove that the radius of n^{th} dark ring due to λ_1 is $(2\lambda_1\lambda_2R/\lambda_1 - \lambda_2)^{1/2}$ 5
- (c) Derive the condition of fringes of equal width in a wedge shaped film and explain. 5
6. (a) A diffraction grating which has 4000 lines in 1cm is used at normal incidence. Calculate the dispersive power of the grating in the third order spectrum in the wavelength region 5000 Å. 5
- (b) Discuss the Weiss's theory of ferromagnetism and derive Curie-Weiss's law, 5
- (c) Explain the working of SEM with a neat diagram. 5
7. Write short notes on any three. 15
- (a) Holography as an application of laser.
- (b) Diffusion pump.
- (c) Antireflection coating.
- (d) Optical fibre communication system.

N.B. (i) Question no. ONE is compulsory.

(ii) Attempt any FOUR questions from remaining six questions.

(iii) Figures to right indicate full marks.

Q. 1 (a) Prove that

$$\int_0^{\infty} \frac{x^6(1-x^{10})}{(1+x)^{24}} dx = 0$$

(b) Solve

$$\frac{d^3 y}{dx^3} + 4 \frac{d^2 y}{dx^2} + \frac{dy}{dx} - 6y = 0$$

(c) Evaluate

$$\int_0^2 \int_1^2 \int_0^2 xyz \, dx \, dy \, dz$$

(d) Evaluate

$$\int_0^1 \int_0^x e^{y/x} \, dy \, dx$$

(e) Solve $(4x+3y-4)dx + (3x-7y-3)dy = 0$

(f) Using Euler's method find the approximate value of y where

$$\frac{dy}{dx} = xy, \quad y(0) = 2 \text{ taking } h = 0.2 \text{ at } x = 1$$

Q.2 (a) Evaluate

$$\int_0^1 \int_0^{\sqrt{1-y^2}} (x^2 + y^2) \, dx \, dy$$

(b) Evaluate $\iiint (x^2 + y^2 + z^2) \, dx \, dy \, dz$ over the first octant of the sphere

$$x^2 + y^2 + z^2 = a^2$$

(c) Evaluate

$$\int_0^{\infty} \frac{e^{-x}}{x} (1 - e^{-ax}) \, dx, \quad a > -1 \quad \text{Hence evaluate} \quad \int_0^{\infty} \frac{e^{-x}}{x} (1 - e^{-7x}) \, dx$$

Q.3 (a) Solve $y(x+y) \, dx - x(y-x) \, dy = 0$

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Q. 3 (a) Solve $y(x+y) \, dx - x(y-x) \, dy = 0$

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- (b) Find by double integration the area bounded by

$$y^2 = 4ax \text{ and } x^2 = 4by$$

- (c) Solve

$$\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 3y = (x^2 e^x)^2$$

- Q.4 (a) Solve

$$\frac{dy}{dx} + \frac{2x}{(x^2 + 1)} y = \frac{4x^2}{(x^2 + 1)}$$

- (b) Change the order of integration and evaluate

$$\int_0^5 \int_{2-x}^{2+x} dy dx$$

- (c) Using Taylor's series method solve

$$\frac{dy}{dx} = x^2 - y, \text{ with } x_0 = 0, y_0 = 1. \text{ Find } y \text{ when } x = 0.1$$

- Q.5 (a) Find the length of the cardioide $r = a(1 + \cos \theta)$ which lies outside the circle $r + a \cos \theta = 0$

- (b) Find the volume of the solid that lies under the plane $3x + 2y + z = 12$ and above the rectangle $R = \{(x, y) | 0 \leq x \leq 1, -2 \leq y \leq 3\}$

- (c) Solve numerically (using Runge - Kutta Method of Fourth order) the differential equation $\frac{dy}{dx} = xy$ with initial conditions $y(1) = 2$ and find y at $x = 1.2, 1.4$

- Q.6 (a) Evaluate

$$\int_0^1 x^6 (1 - x^2)^{1/2} dx$$

- (b) Evaluate

$$\iint_R \sqrt{xy - y^2} dx dy \text{ where } R \text{ is a triangle whose vertices are } (0, 0), (10, 1) \text{ and } (1, 1)$$

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