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B. Tech. (First and Second Semester)

Examination, Nov.-Dec. 2023

(New Scheme)

**(AEI, Biotech, Chem., Civil, CSE, Elect., EEE, EI,
Et & T, IT, Mech., Mining, Metallurgy, Mechatronics,
Production, Automobile, Agriculture Branch)**

PHYSICS-I

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

***Note : Attempt five questions branch wise. Part (a) of
each question is compulsory and carries 4 marks
each. Attempt any two part from (b), (c) and (d)
of each question carrying 8 marks.***

Unit-I

1. (a) Explain conservative and non-conservative forces with example. 4

- (b) A projectile is fired with a velocity making an angle θ with horizontal. Show that its trajectory is parabola. Derive expression for time of flight and horizontal range. 8
- (c) What is centripetal acceleration? Find its magnitude and direction in case of a uniform circular motion of an object. 8
- (d) (i) A ball is kicked at angle of 35° with the ground : 6
- (A) What should be the initial velocity of the ball so that it hits a target that is 30 m away at a height of 1.8 m?
- (B) What is the time of the ball to reach the target?
- (ii) Convert 1 kWh into Joules. 2

Unit-II

2. (a) Deduce the relation between linear and angular acceleration. 4
- (b) What is moment of Inertia? Derive an expression for moment of inertia of a thin circular ring about

- an axis passing through its centre and perpendicular to the plane of the ring. 8
- (c) Derive the three equations of rotational motion under constant angular acceleration. 8
- (d) (i) State and prove parallel axis theorem. 4
- (ii) A wheel is rotating at a rate of 1000 rpm and its kinetic energy 10^6 J. Determine the moment of inertia of the wheel about its axis of rotation. 4

Unit-III

3. (a) What do you understand by resolving power of an optical instrument? State Rayleigh criteria for resolution? 4
- (b) What is a Fresnel's biprism? How can Fresnel's biprism be used in finding out the thickness of a thin sheet of transparent material? 8
- (c) What is a plane diffraction grating? Discuss its theory and derive the condition for secondary maxima and minima. Also show the diffraction pattern. 8

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- (d) (i) A wedge shaped air film is formed between two glass plates by placing a paper at one of the sides. On illuminating this film by a light of 6000 \AA wavelength, 10 fringes are seen in 1 cm. If the light is incident normally, find the angle of the wedge. 4
- (ii) Explain the formation of Newton's rings. Why the centre of Newton's ring is black? 4

Unit-IV

4. (a) Deduce the relation between electric field and electrostatic potential. 4
- (b) What is dielectric polarization? Explain different types of dielectric polarizations. 8
- (c) Define and explain the divergence and curl of electric field. What is their physical significance? Derive an expression for curl of an electric field in cartesian coordinate system. 8
- (d) Explain the laws of electrostatics. Derive Laplace's and Poisson's equation for an electrostatic potential. 8

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Unit-V

5. (a) Explain Biot – Savart law and its importance. 4
- (b) Give the detail classification of magnetic materials. 8
- (c) What do you mean by divergence and curl of a vector field? State and prove Stoke's theorem related to curl of a vector field. 8
- (d) (i) What are hard and soft magnetic material? Give their applications. 4
- (ii) A straight wire carries 6A from south and north direction. What is the magnetic field due to 1 cm piece of wire at a point 50 cm, 30 degree east of north? 4

Unit-VI

6. (a) Explain Faraday's law of electromagnetic induction. 4
- (b) Discuss the energy in an electromagnetic field and hence define the Poynting vector, deriving the required expression. 8
- (c) Prove that
- (i) $\text{div } \vec{B} = 0$

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- (ii) $\text{div } \vec{D} = \rho$ 8
- (d) (i) Use Maxwell's equation to derive the equation of continuity of charge current. 4
- (ii) Distinguish between conduction current and displacement current. 4

Unit-VII

7. (a) Explain Heisenberg's uncertainty principle with an example. 4
- (b) Explain De Broglie's hypothesis of matter waves? Derive the expression for De Broglie's wavelength. How was the De Broglie's wavelength of electron determined and verified by Davisson and Germer's Experiment? 8
- (c) Derive Schrödinger's Time dependent and Time independent wave equation. 8
- (d) (i) Calculate the energy in electron volt of a photon of wavelength 1 \AA . What is the momentum of this photon? 4
- (ii) An electron has a speed of 600 m/s with an

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accuracy of 0.005%. Calculate the certainty with which we locate the position of the electron. 4

Unit-VIII

8. (a) Write short notes on :
- (i) Effective mass 4
- (ii) Intrinsic and Extrinsic semiconductors. 4
- (b) Discuss the Kronig - Penny model for the motion of an electron in a periodic potential. Explore the conclusions regarding E-K diagram in solids. 8
- (c) Describe the formation of energy bands in solids and discuss the concept of direct and indirect band gap semiconductors. 8
- (d) (i) Fermi energy of a given substance is 7.9 eV. What is the average energy and speed of electron in this substance at 0 K? 4
- (ii) Explain the quantum theory of free electrons in metals. 4

Unit-IX

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9. (a) (i) In a semiconductor all the states at 0 K in valence band are 4
- (ii) State Law of mass action. 4
- (b) How does the Fermi Level changed with increasing temperature in both n-type and p-type semiconductors. Sketch the digrams. 8
- (c) Write short notes on : 8
- (i) Drift and diffusion current
- (ii) Charge neutrality condition
- (d) (i) The Fermi level for potassium is 2.1 eV. Calculate the velocity of the electrons at the fermi level. 4
- (ii) In a p-type germanium $n_i = 2.1 \times 10^{19} \text{ m}^{-3}$ and density Boron is $4.5 \times 10^{23} \text{ atoms m}^{-3}$. The electron and hole mobilities are 0.4 and $0.2 \text{ m}^2 \text{ V}^{-1} \text{ s}^{-1}$ respectively. What is its electrical conductivity before and after the adition of boron atoms? 4

Unit-X

10. (a) What is ment by modes? Compare a single mode and multimode fibre. 4

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- (b) Explain the terms : (any two) 8
- (i) Stimulated emission
- (ii) Population inversion
- (iii) Acceptance angle for an optical fibre.
- (c) With the help of a neat energy level diagram explain how population inversion is achieved in He-Ne laser. What is the role of helium gas? 8
- (d) (i) Estimate the critical angle when the core refractive index is 1.48 and relative refractive index is 2% 4
- (ii) Calculate the wavelength of the emission from GaAs semiconductor laser whose band energy is 3 eV. 4

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B.Tech. (First Semester) Examination

Nov.-Dec. 2023

(AICTE Scheme) (P1 Group)

(Common to all Branches)

MATHEMATICS-I

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt questions of all units. Part (a) of each unit is compulsory and carries 4 marks each. Attempt any two parts from (b), (c) and (d) of each unit which carries 8 marks each.

Unit-I

1. (a) Define Beta and Gamma functions.

(b) Prove that :

$$\beta\left(m, \frac{1}{2}\right) = 2^{2m-1} \beta(m, m)$$

(c) Show that

$$\int_0^{\pi/2} \cos^m x \cos nx \, dx = \frac{m}{n} \int_0^{\pi/2} \cos^{m-1} x \cos(n-1)x \, dx$$

Hence deduce that

$$\int_0^{\pi/2} \cos^n x \cos nx \, dx = \frac{\pi}{2^{n+1}}$$

(d) Evaluate :

$$I_n = \int_0^a (a^2 - x^2)^n \, dx$$

where n is positive integer

Hence deduce that :

$$I_n = \frac{2n}{2n+1} a^2 I_{n-1}$$

Unit-II

2. (a) State and verify Cauchy's Mean Value theorem for $\sin x$ and $\cos x$ in $[a, b]$.

(b) Use Taylor's series to prove that

$$\tan^{-1}(x+h) = \tan^{-1} x + h \sin z - \frac{(h \sin z)^2 \sin 2z}{2} \dots \dots \dots \infty$$

where $z = \cot^{-1} x$.

(c) Evaluate :

$$\lim_{x \rightarrow 0} \left(\frac{1}{x} - \frac{1}{e^x - 1} \right)$$

(d) Show that the right circular cylinder of given surface and maximum volume is such that its height is equal to the diameter of the base.

Unit-III

3. (a) State the prove Parseval's formula.
 (b) Discuss the Convergence of the series

$$\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \dots \dots \dots \infty$$

- (c) Discuss the Convergence of the series

$$\sum_{n=1}^{\infty} \frac{n!}{(n^n)^2}$$

- (d) Express $f(x) = x$ as a half range Cosine series.

Unit-IV

4. (a) Define Solenoidal and Irrotational vectors.

- (b) If $z(x+y) = x^2 + y^2$,

show that

$$z \left(\frac{\partial z}{\partial x} - \frac{\partial z}{\partial y} \right)^2 = 4 \left(1 - \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y} \right)$$

- (c) A rectangular box open at the top is to have a volume of 32 cubic feet. Find the diameter of the box requiring least material for construction.

- (d) Find the Directional derivative $f(x, y, z) = x^2yz + 4xz^2$ at point (1, -2, 1) in the direction $2\hat{i} - \hat{j} - 2\hat{k}$.

Unit-V

5. (a) Define Rank of the Matrix.

- (b) Investigate the value of λ and μ so that the equations

$$2x + 3y + 5z = 9,$$

$$7x + 3y - 2z = 8,$$

$$2x + 3y + \lambda z = \mu$$

have

- (i) No solution
- (ii) A unique solution
- (iii) An infinite number of solutions.

(c) Find the characteristic equation of the matrix

$$\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$$

and hence compute A^{-1} .

Also find the matrix represented by :

$$A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I$$

(d) Find the Eigen value and Eigen vector for

$$\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$$

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**B. Tech. (First Semester) Examination,
Nov.-Dec. 2023**

(AICTE Scheme)

(Common to all Branches) (P1 Group)

**BASIC ELECTRICAL and ELECTRONICS
ENGINEERING**

Time Allowed : Three hours

Maximum Marks : 100

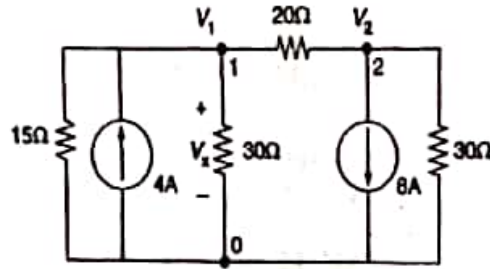
Minimum Pass Marks : 35

Note : Attempt all questions. Part (a) of each question is compulsory. Attempt and solve any two parts (b), (c) and (d).

Unit-I

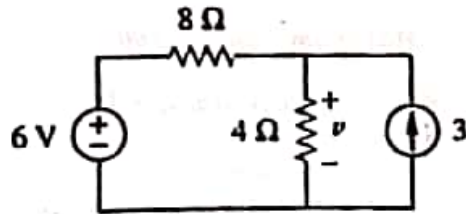
1. (a) State and explain Kirchhoff's law. 4
- (b) For the circuit of fig. below determine V_x using nodal analysis 8

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(c) Use the superposition theorem to find v in the circuit fig.

8



(d) Define Flux Density, Magnetic field Intensity, Leakage Flux and Fringing.

8

Unit-II

2. (a) Define root mean square and average values.

4

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(b) The instantaneous value of emf is $V = 300 \sin 80 \pi t$.

8

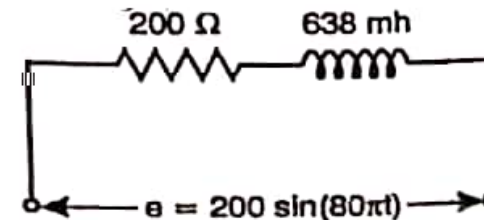
Determine :

- (i) Average value
- (ii) rms value
- (iii) Frequency
- (iv) Period
- (v) Angular Frequency
- (vi) Amplitude
- (vii) Instantaneous value of emf at $t = 0.1$ sec.

(c) For circuit shown in fig. Write :

- (i) expression for current
- (ii) Phase difference
- (iii) frequency
- (iv) r.m.s value of current

8



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- (d) A series R-L-C circuit consists of $R = 10 \Omega$, $L = 0.318 \text{ H}$, $C = 63.6 \mu\text{F}$ and emf source $e(t) = 100 \sin 314 t$. 8

Calculate :

- (i) Expression for it
- (ii) Phase angle between voltage and current
- (iii) Power factor
- (iv) Active power consumed

Unit-III

3. (a) Define transformer, state its necessity and applications. 4
- (b) Explain principle of operation of transformers. 8
- (c) A 25 kVA transformer has 500 turns on the primary and 50 turns on the secondary winding. The primary is connected to 3000 V, 50 Hz supply. Find the full load primary and secondary currents, secondary emf and the maximum flux in the core, Neglect leakage drops and no load primary current. 8

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- (d) The efficiency of 20 kVA, 2500 V/250 V, Single phase transformer at upf is 98% at rated load and at half rated load. Determine transformer core loss and full load copper loss. At what load maximum efficiency will occur? 8

Unit-IV

4. (a) Distinguish between intrinsic and extrinsic semiconductors. 4
- (b) Illustrate PN-junction diode. 8
- (c) An Si diode has $I_s = 10 \text{ nA}$ operating at 25°C . Calculate I_D for a forward bias of 0.6 V. (consider $\eta = 2$). 8
- (d) Write a note on LED. 8

Unit-V

5. (a) In a BJT, the emitter current is 8 mA and $I_B = I_C / 100$. Determine I_C and I_B . 4
- (b) Draw transistor symbols. Explain the operation of pnp transistor. 8

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- (c) Explain different region of operation of a transistor in CE configuration. 8
- (d) Describe operation of Transistor as an Amplifier and as a Switch. 8

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**B. Tech. (Second Semester) Examination,
Nov.-Dec. 2023**

(New AICTE Scheme)

(Common to all Branches : Q1 Group)

ENGINEERING GRAPHICS and DESIGN

Time Allowed : Four hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt questions from all units. Part (a) of each question is compulsory and carries 4 marks. Attempt any two parts from (b), (c) and (d) of each question and carries 8 marks each. Explain your answer with neat sketches wherever necessary.

Unit-I

1. (a) Define Engineering drawing and its classification. 4
- (b) What is Dimensioning? Differentiate between aligned and unidirectional systems of a linear dimensioning. 8

- (c) (i) Define R.F. and classify scales on the basis of R.F.
- (ii) Differentiate between Plain and Diagonal scale. 8
- (d) Draw the conventional signs of different types of lines used in engineering practice according to B.I.S. 8

Unit-II

- 2. (a) Define principal planes H.P. and V.P. 4
- (b) Define Projection. What are the four types of projection? Explain any two of them. 8
- (c) Differentiate between first angle projection system and third angle projection system. 8
- (d) What do you mean by isometric projection and also explain about isometric scale and the methods to draw isometric scale? 8

Unit-III

- 3. (a) What is the use of Layer in AUTOCAD? Explain. 4
- (b) What is Computer Aided Drafting and Design (CAD)? Explain its benefits and limitations. 8

- (c) Write about the status bar command buttons. Explain SNAP, GRID, OSNAP, ORTHO and POLAR. 8
- (d) Explain the procedure to set limits of drawing space and units in AutoCAD with suitable example. 8

Unit-IV

- 4. (a) What is the difference between LINE and POLYLINE command? Explain with suitable example. 4
- (b) Explain different methods used for drawing in AutoCAD : 8
 - (i) Circle
 - (ii) ARC
 - (iii) Ellipse
- (c) Explain the functions of the following commands with examples : 8
 - (i) Trim
 - (ii) Hatch
 - (iii) Offset
 - (iv) Scale

- (d) Describe the following command with examples : 8
- (i) Point
 - (ii) Line
 - (iii) PLINE
 - (iv) Rectangle

Unit-V

5. (a) How many types of 3-D geometrical models? 4
- (b) Differentiate between Wireframe and Surface modelling. 8
- (c) Explain following commands : 8
- (i) 3-D Copy
 - (ii) 3-D Move
 - (iii) Rotate
 - (iv) Scale
- (d) Explain following tools : 8
- (i) Extrude
 - (ii) Revolve
 - (iii) Sweep
 - (iv) Torus

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**B. Tech. (First Semester) Examination,
Nov.-Dec. 2023**

(Common to all Branches)

FUNDAMENTALS of COMPUTER

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt all questions. Part (a) of each question is compulsory and carries 4 marks. Attempt any two parts from part (b), (c) and (d) of each question and carries 08 marks each.

Unit-I

- I. (a) Write down definition of computer and block diagram of it.**

4

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- (b) Explain the Memory hierarchy in detail. 8
- (c) Describe 4 input device and 4 output device in detail. 8
- (d) Explain types of data and concept of data and information. 8

Unit-II

2. (a) Define computer peripherals. 4
- (b) Explain operating system its functionality. 8
- (c) Describe plug and play device give any 3 examples. 8
- (d) Short notes on : 8
- (i) System utilities
 - (ii) Antivirus software

Unit-III

3. (a) What is word processing and what is the use of thesaurus in MS word? 4
- (b) Describe MS PowerPoint presentation and describe basic presentation tools 8

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- (c) Write short notes on : 8
- (i) Opening and closing documents
 - (ii) Printing of spread sheet
 - (iii) Organization charts
 - (iv) Hyper link
- (d) Explain MS Excel detail and how to use a formula is MS Excel write down any 5 formula. 8

Unit-IV

4. (a) Explain www and web browsers. 4
- (b) Describe various networking device in computer network in detail. 8
- (c) Explain working of electronic mailing system. 8
- (d) Short notes on : 8
- (i) URL
 - (ii) Bluetooth technology
 - (iii) IP address
 - (iv) Kindle

Unit-V

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5. (a) What is cyber security what its needs are? 4
- (b) Explain computer application in office automation in detail. 8
- (c) Describe 9 pillars of mission digital India detail. 8
- (d) Write short notes on : 8
- (i) Audio and video conferencing
 - (ii) KYC
 - (iii) Social networking
 - (iv) Inventory control

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B. Tech. (First Semester) Examination

Nov.-Dec. 2023

(Lateral Entry)

PHYSICS

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt all questions. Part (a) of each question is compulsory. Attempt any two out of three remaining parts (b), (c) and (d). Assume data wherever necessary.

Unit-I

1. (a) Name the two quantities for each having dimensions : 4

(i) ML^2T^{-2}

- (ii) $ML^2 T^{-2} K^1$
- (b) Write the equations of motion in circular motion and derive expression for the magnitude of centripetal acceleration. 8
- (c) Write short notes on : (any two) 8
- (i) Conservative and non conservative forces
- (ii) Central forces
- (iii) Position & velocity vector
- (d) A cricket ball is thrown at a speed 28 m/s in a direction 30° above the horizontal. Calculate : 8
- (i) The maximum height,
- (ii) The time taken by the ball to return to the same level, and
- (iii) The distance from the thrower to the point where the ball returns to the same level. ($g = 9.8 \text{ m/s}^2$).

Unit-II

2. (a) Give the difference between Fresnel and Fraunhofer diffractions of light. 4

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- (b) What is Fresnel's biprism? Give the production and theory of fringes produced by it. 8
- (c) Describe Fraunhofer diffraction due to single slit and derive the positions of the maxima and minima. 8
- (d) (i) In Newton's ring experiment the diameter of the 15th ring was found to be 0.59 cm and that of the 5th ring was 0.36 cm. If the radius of the plano convex lens is 100 cm compute the wavelength of light used. 4
- (ii) What is the highest order spectrum which may be seen with monochromatic light of wavelength 5000 Å by means of diffraction grating with 5000 lines/cm. 4

Unit-III

3. (a) Briefly explain about Magnetic Domains. 4
- (b) What is meant by polarization of a substance? Derive the expression of relation between E, D and P. 8
- (c) Write short notes on any two : 8
- (i) Diamagnetic material

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- (ii) Hysteresis loop
- (iii) Susceptibility
- (d) (i) The atomic weight and density of Sulphur are 32 and 2.08 gm/cm³ respectively. The electronic polarizability of the atom is 3.28×10^{-40} F.m². If Sulphur solid has cubical symmetry, what will be its relative dielectric constant? 4
- (ii) Dimagnetic Al₂O₃ is subjected to a magnetic field of 10⁵ A/m. Evaluate magnetization and magnetic flux density in Al₂O₃. (Susceptibility of Al₂O₃ = 5×10^{-5}). 4

Unit-IV

- 4. (a) Define Carrier Generation and recombination with a suitable diagram. 4
- (b) What is the Fermi level? Show that there is a fermi level in the intrinsic semiconductor between the valence band and conduction band. 8
- (c) What is a P-N junction diode? Derive an expression for a potential barrier in the P-N junction diode. 8

- (d) (i) Find the resistivity of intrinsic germanium at 300°K. Given that the intrinsic density of carriers is $2.5 \times 10^{19}/m^3$. (Given : Mobility of electron = 0.39 and Hole = $0.19 \text{ m}^2\text{V}^{-1}\text{s}^{-1}$) 4
- (ii) Calculate the potential barrier for a germanium P-N junction at room temperature, if both the p and n regions are doped equally and to the extent of one atom per 10⁶ germanium atoms. ($n_i = 2.4 \times 10^{19}/m^3$ and number of atoms in germanium $4.4 \times 10^{28}/m^3$). 4

Unit-V

- 5. (a) Define the term total internal reflection with a suitable diagram. 4
- (b) Give the laser characteristics. Explain the principle and working of the helium-neon laser. 8
- (c) Explain the principle of propagation of light within fibre and give expression for acceptance angle and Numerical Aperture. 8
- (d) (i) Determine the normalized frequency for step index fibre having a 25 μm core radius, $n_1 =$

- 1.98 and $n_2 = 1.46$. How many modes propagate in this fibre at $0.82 \mu\text{m}$? 4
- (ii) Calculate the energy of laser pulse in a ruby laser for 2.8×10^{19} Cr^{3+} ions. If the laser emits radiation for wavelength 6943 \AA . 4