31037

NIRA-V (2014 COURSE) : WINTER 2016
SUBJECT : ELECTIVE-I – ELEMENTS OF MATERIALS SCIENCE

Day : Monday
Date : 17/10/2016

Time : 12.00 NOON TO 02.00 PM
Max. Marks : 40.

N.B.:
1) All questions are **COMPULSORY.**
2) Figures to the **RIGHT** indicate full marks.
3) Draw neat labeled diagrams **WHEREVER** necessary.

Q.1 Attempt any **TWO** of the following: **(10)**

a) Describe various types of defects.

b) Explain the properties of materials – resistivity and specific heat.

c) Draw and explain in brief the phase diagram of sugar – water solution.

Q.2 Attempt any **TWO** of the following: **(10)**

a) State and explain various applications of smart materials.

b) Define deformation. Distinguish between elastic and plastic deformation.

c) What is the elastic strain in a copper rod that is stresses to 70MPa. (Given: Modulus of elasticity of Cu = 1,10,000MPa).

Q.3 Attempt any **TWO** of the following: **(10)**

a) Explain (i) Metals and (ii) Semiconductors.

b) State and prove Gibb's phase rule.

c) How many grams of sulphur is needed per 50 g of final rubber product to completely cross-link a polybutadiene $(-C_4H_6-)_n$ rubber with sulphur according to the pattern of vulcanization. (Given: Atomic weight of Sulphur=32, Carbon=12, Hydrogen=1).

Q.4 Attempt any **FIVE** of the following: **(10)**

a) State characteristics of polymer.

b) Explain hard and soft ferrites.

c) Define degree of polymerization.

d) State the properties of single phase alloys.

e) State Fick's first law for atomic diffusion.

f) Define dielectric strength of a material.

g) Give mechanical properties of materials.

* * *

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g) Give mechanical properties of materials.

* * *

31022

NIRA-V (2014 COURSE): WINTER 2016
SUBJECT : SOLID STATE PHYSICS

Day : Friday
Date : 07/10/2016

Time : 12.00 NOON TO 02.00 PM
Max. Marks : 40.

N.B.:

1) All questions are **COMPULSORY.**
2) Figures to the **RIGHT** indicate full marks.
3) Draw neat labeled diagrams **WHEREVER** necessary.

Q.1 Attempt any **TWO** of the following: **(10)**

a) What do you mean by FCC, BCC, SC structures Find out the coordination number these structure.
b) Find the expression for the specific heat of a solid on the basis Einstein model and show that it converges to 3R at high temperatures.
c) Obtain an expression for energy levels in one dimensional lattice.

Q.2 Attempt any **TWO** of the following: **(10)**

a) Explain the Ewald's construction and obtain the formula $2K.G+G^2=0$.
b) Define Hall coefficient, Hall mobility. Explain the Hall Effect in a material. Explain the significance of sign of Hall coefficient.
c) Derive an expression for lattice heat capacity using classical theory of lattice heat capacity.

Q.3 Attempt any **TWO** of the following: **(10)**

a) Explain what is meant by symmetry operations? Explain any two examples.
b) Discuss the method of investigating the structure of single crystal using X-ray.
c) Show that the total energy of free electron gas at 0^0K is $\frac{3}{5}NE_f$.

Q.4 Attempt any **FIVE** of the following: **(10)**

a) Define i) a primitive cell and ii) unit cell.
b) For the elastic continuum the number of modes of vibrations is given by $Z(v)\,dv=4\pi V v^2\left(\frac{2}{C_t^3}+\frac{1}{C_l^3}\right)dv$, explain the notation used.
c) How does the Debye model differ from the Einstein's model of lattice heat capacity?
d) The planes (111) and (222) are different but directions are (111) and (222) are same. Draw neat sketches.
e) Explain the terms Fermi energy & Fermi level.
f) A plane has intercepts on the three axis a, b, c at 3a, 2b, 5c respectively. What are its miller indices?
g) Calculate the distance between two lattice planes which give first order diffraction at an angle of 26.42 degree with Molybdenum X-ray of wavelength 0.75 A^0.

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31022

NIRA-V (2014 COURSE): WINTER 2016
SUBJECT : SOLID STATE PHYSICS

Day : Friday
Date : 07/10/2016

Time : 12.00 NOON TO 02.00 PM
Max. Marks : 40.

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31032

NIRA-V (2014 COURSE) : WINTER 2016
SUBJECT : CLASSICAL MECHANICS (Physics).

Date : Friday
Date : 14/10/2016

Time : 12.00 NOON TO 02.00 PM
Max. Marks : 40.

N.B.:

1) All questions are **COMPULSORY.**
2) Figures to the **RIGHT** indicate full marks.
3) Draw neat and labeled diagrams **WHEREVER** necessary.

Q.1 Attempt any **TWO** of the following: **(10)**

a) Show that path of a charged particle moving with uniform velocity in a constant magnetic field is a circle.
b) Set up the Langrangian function for compound pendulum and solve it.
c) State and prove Kepler's third law of planetary motion.

Q.2 Attempt any **TWO** of the following: **(10)**

a) Show that the path of charged particle moving with a uniform velocity in a transverse electric field is a parabola.
b) What do you mean by constrains on the mechanical system? Explain in short, types of constraints.
c) What do mean by Corioli's force in moving coordinate system, give one phenomena in nature arising due to the Corioli's force.

Q.3 Attempt any **TWO** of the following: **(10)**

a) Obtain the relation between the time derivatives in moving coordinate system and fixed coordinate system.
b) Apply D' Alembert's principle to get the acceleration in Atwood's machine.
c) Draw a rough graph of effective potential energy against position vector and explain quantitatively different shapes of orbits.

Q.4 Attempt any **FIVE** of the following: **(10)**

a) What is the central force field? State its characteristics.
b) Why earth is flattened at the poles?
c) State when the Hamiltonian is total energy and when it is conserved?
d) When is a force field said to be conservative? Give illustration.
e) A spring is kept compressed by tying its ends tightly together. It is then placed in acid where it dissolves. What happens to its stored potential energy?
f) Write the equation of motion of a charged particle moving under the action of electric and magnetic field.

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31032

NIRA-V (2014 COURSE) : WINTER 2016
SUBJECT : CLASSICAL MECHANICS (Physics).

Date : Friday
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Time : 12.00 NOON TO 02.00 PM
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31017

NIRA-V (2014 COURSE) : WINTER 2016
SUBJECT : QUANTUM MECHANICS

Day : Wednesday
Date : 05/10/2016

Time : 12.00 NOON TO 02.00 PM
Max. Marks : 40.

N.B.:

1) All questions are **COMPULSORY.**
2) Figures to the **RIGHT** indicate full marks.
3) Draw neat labeled diagrams **WHEREVER** necessary.

Q.1 Attempt any **TWO** questions: **(10)**

a) Obtain expression for reflection and transmission probability for the particle in infinite potential well.
b) Explain the Heisenberg's uncertainty principle using γ-ray microscope experiment.
c) Obtain an expression for time dependent Schodinger's wave equation

Q.2 Attempt any **TWO** questions: **(10)**

a) Explain the concept of eigenvalue and eigen function and what do you mean by expectation value.
b) Obtain the probability current density associated with the function $\Psi(x) = A\, e^{ikx}$.
c) Prove the Ehrenfest theorem $\frac{d\langle x\rangle}{dt} = -\frac{\langle p_x\rangle}{m}$

Q.3 Attempt any **TWO** questions: **(10)**

a) Explain the various quantum mechanical operators with equations.
b) Derive the expression for phase velocity and group velocity.
c) Obtain an expression for the particle in one dimensional rigid box and calculate the reflection (R) coefficient for it.

Q.4 Attempt any **FIVE** questions: **(10)**

a) Explain the dual nature of matter waves.
b) Show that $[A,[B,C]]+[B,[C,A]]+[C,[A,B]] = 0$.
c) State the Ladder operators.
d) Calculate the De- Broglie's wavelength of an electron produced by accelerating potential of 50V.
(Given $h = 6.063 \times 10^{-34}$Js and $m = 9.1 \times 10^{-31}$kg).
e) Define the terms expectation value.
f) What are the different characteristics of wave function?

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31017

NIRA-V (2014 COURSE) : WINTER 2016
SUBJECT : QUANTUM MECHANICS

Day : Wednesday
Date : 05/10/2016

Time : 12.00 NOON TO 02.00 PM
Max. Marks : 40.

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(Given h = 6.063 x 10^{-34}Js and m = 9.1 x 10^{-31}kg).
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31039

NIRA – V (2014 COURSE): WINTER – 2016
SUBJECT : BOTANY : OPTIONAL : AEROBIOLOGY (B – 56)

Day Monday
Date 17-10-2016

Time : 12:00NOON TO 2:00 P.M.
Max. Marks : 40

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Draw neat and labeled diagrams **WHEREVER** necessary.

Q.1 Attempt **ANY TWO** of the following: **[10]**

a) Explain various methods of plant disease forecasting in the aerobiology.

b) Define aerobiology. Explain in brief scientific contribution of any two aerobiologists.

c) Give qualitative methods of sampling.

Q.2 Attempt **ANY TWO** of the following: **[10]**

a) Explain working and uses of Anderson air sampler.

b) Give identification methods of airborne biological material with respect to pollen and bacteria.

c) Explain the concept of aerobiopollutants.

Q.3 Attempt **ANY TWO** of the following: **[10]**

a) Describe qualitative method of sampling.

b) Explain principles of plant disease forecasting in aerobiology.

c) Describe impact of aerobiopollutants on animals.

Q.4 Attempt **ANY FIVE** of the following: **[10]**

a) Rotorod air sampler

b) Day and night aerospora

c) Rainfall and humidity as a meterological parameters

d) House dust mites

e) Biodeterioration

f) Intramural method of sampling

g) Human skin diseases

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31039

NIRA – V (2014 COURSE): WINTER – 2016
SUBJECT : BOTANY : OPTIONAL : AEROBIOLOGY (B – 56)

Day Monday
Date 17-10-2016

Time : 12:00NOON TO 2:00 P.M.
Max. Marks : 40

N.B.:

1) All questions are **COMPULSORY**.
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c) Rainfall and humidity as a meterological parameters

d) House dust mites

e) Biodeterioration

f) Intramural method of sampling

g) Human skin diseases

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B. Sc. 2014 Sem - II & IV

30983

NIRA – II (2014 COURSE): WINTER – 2016

SUBJECT : MATHEMATICS : INTEGRAL CALCULUS & DIFFERENTIAL EQUATIONS

Day : Friday
Date : 21/10/2016

Time : 12.00 NOON TO 02.00 PM
Max. Marks : 40

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.

Q.1 Attempt **ANY TWO** of the following: **[10]**

a) Evaluate : $\int \frac{dx}{x^4+1}\,dx.$

b) Evaluate : $\int \frac{x^2+2}{x^3-1}\,dx$

c) Evaluate : $\int \frac{x^2\,dx}{(x-1)^3\,(x+1)}.$

Q.2 Attempt **ANY TWO** of the following: **[10]**

a) Explain the method of finding solution of non-homogeneous differential equation of the first order and first degree of the form.
$\frac{dy}{dx} = \frac{a_1x+b_1y+c_1}{a_2x+b_2y+c_2}$, where $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

b) Solve : $(x^2y^2 + xy + 1)y\,dx + (x^2y^2 - xy + 1)x\,dy = 0.$

c) Solve : $\frac{dy}{dx} + xy = x^3y^3.$

Q.3 Attempt **ANY TWO** of the following: **[10]**

a) Find the length of the arc of the parabola $x^2 = 4ay$ measured from the vertex to one extremity of the latus – rectum.

b) Find the surface area of the solid generated by revolving the cycloid $x = a\,(\theta - \sin\theta)$, $y = a\,(1 - \cos\theta)$ about the line $y = 0$.

c) Find the orthogonal trajectories of the family of rectangular hyperbolas $xy = c^2$.

Q.4 Attempt **ANY FIVE** of the following: **[10]**

a) Prove that $\int_0^{\pi/2} (\cos x)^n\,dx = \frac{n-1}{n} \int_0^{\pi/2} (\cos x)^{n-2}\,dx.$

b) Evaluate : $\int_0^{\pi 2} \sin^{10} x\,dx.$

c) Evaluate : $\int_0^{\pi 2} \cos^5 x.\,\sin^{10} x\,dx$

d) Find the volume of the sphere of radius a; by integration.

e) Obtain the differential equation of the family of curves $y = e^x$ (Acosx + Bsinx).

f) Find the integrating factor of the differential equation
$(x^2y - 2xy^2)\,dx - (x^3 - 3x^2y)\,dy = 0$

g) Solve : $(2x^3 + 3y)\,dx + (3x + y - 1)\,dy = 0$

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30983

NIRA – II (2014 COURSE): WINTER – 2016

SUBJECT : MATHEMATICS : INTEGRAL CALCULUS & DIFFERENTIAL EQUATIONS

Day : Friday
Date : 21/10/2016

Time : 12.00 NOON TO 02.00 PM
Max. Marks : 40

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.

Q.1 Attempt **ANY TWO** of the following: **[10]**

a) Evaluate : $\int \frac{dx}{x^4+1}\,dx.$

b) Evaluate : $\int \frac{x^2+2}{x^3-1}\,dx$

c) Evaluate : $\int \frac{x^2\,dx}{(x-1)^3\,(x+1)}.$

Q.2 Attempt **ANY TWO** of the following: **[10]**

a) Explain the method of finding solution of non-homogeneous differential equation of the first order and first degree of the form.
$\frac{dy}{dx} = \frac{a_1x+b_1y+c_1}{a_2x+b_2y+c_2}$, where $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

b) Solve : $(x^2y^2 + xy + 1)y\,dx + (x^2y^2 - xy + 1)x\,dy = 0.$

c) Solve : $\frac{dy}{dx} + xy = x^3y^3.$

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a) Prove that $\int_0^{\pi/2} (\cos x)^n\,dx = \frac{n-1}{n} \int_0^{\pi/2} (\cos x)^{n-2}\,dx.$

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f) Find the integrating factor of the differential equation
$(x^2y - 2xy^2)\,dx - (x^3 - 3x^2y)\,dy = 0$

g) Solve : $(2x^3 + 3y)\,dx + (3x + y - 1)\,dy = 0$

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30974

NIRA-II (2014 COURSE) : WINTER -2016

SUBJECT : PHYSICS: ELECTRICITY AND MAGNETISM

(For the Students 2015-16 Batch Only)

Day : Monday
Date : 10.10.2016

Time : 12.00 Noon To 2.00 P.M.
Max. Marks : 40.

N.B.:

1) All questions are **COMPULSORY.**
2) Figures to the **RIGHT** indicate full marks.

Q.1 Attempt any **TWO** of the following: **(10)**

a) Explain working of transistor as common base amplifier.
b) State and prove Gauss's law in dielectrics.
c) Define current density. Calculate how many electrons pass through the conductor in one minute? If current through conductor is 160 mA (Given: e = 1.6×10^{-19} C).

Q.2 Attempt any **TWO** of the following: **(10)**

a) Write a note on electric polarisation of matter.
b) Define voltage doubler. Explain half wave voltage doubler in detail.
c) Define magnetic induction. Calculate the magnetic induction at the surface of the aluminium wire of diameter 0.4 cm which carries a current 25 A.

Q.3 Attempt any **TWO** of the following: **(10)**

a) Write a note on power losses in transformers.
b) State and prove maximum power transfer theorem.
c) Explain rise of current in L-R circuit in detail.

Q.4 Attempt any **FIVE** of the following: **(10)**

a) Define electric power. State its unit.
b) Draw neat diagram of L-C-R series resonance circuit.
c) Explain use of filter circuit in brief.
d) Define magnetic susceptibility and permeability.
e) Draw neat diagram of toroid.
f) State Coulomb's law in electrostatics.
g) State Ampere's circuital law.

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30976

NIRA-II (2014 COURSE): WINTER-2016

SUBJECT: BOTANY: PLANT DIVERSITY & UTILIZATION OF PLANTS-II

Day: Friday
Date: 14.10.2016

Time: 12:00 Noon To 2:00 P.M
Max Marks: 40

N.B:

1) All questions are **COMPULSORY**
2) Figures to the right indicate **FULL** marks.
3) Draw neat & labeled diagram **WHEREVER** necessary.

Q.1 Answer any **TWO** of the following: **(10)**

a) What is taxonomy? Give an outline of Bentham and Hooker's system of classification.
b) Describe principles of International code of Botanical nomenclature (ICBN)
c) Give salient features of angiosperms.

Q.2 Answer any **TWO** of the following: **(10)**

a) Give comparative account of morphological characters of Gnetales and Ginkgoales
b) Describe male cone of *Pinus*.
c) Describe industrial products of neem and adulsa as a source of medicines.

Q.3 Answer any **TWO** 0f the following: **(10)**

a) Give morphological characters of family Brassicaceae.
b) Give distinguishing characters of family Papilionaceae.
c) Explain economic importance of family Rubiaceae.

Q.4 Answer any **FIVE** of the following: **(10)**

a) Describe monoadalphous and diadalphous stamens.
b) Give any two evolutionary significance of Gymnosperms.
c) Give floral formula and floral diagram of family Liliaceae.
d) Give morphological characters of *Pinus* needle.
e) Give schematic representation of life cycle of *Pinus*.
f) Write note on fruit siliqua & siliqula.
g) Comment on hypogynous and epigynous flower.

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30976

NIRA-II (2014 COURSE): WINTER-2016

SUBJECT: BOTANY: PLANT DIVERSITY & UTILIZATION OF PLANTS-II

Day: Friday
Date: 14.10.2016

Time: 12.00 Noon To 2.00 P.M
Max Marks: 40

N.B:

1) All questions are **COMPULSORY**
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d) Give morphological characters of *Pinus* needle.
e) Give schematic representation of life cycle of *Pinus*.
f) Write note on fruit siliqua & siliqula.
g) Comment on hypogynous and epigynous flower.

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