First/Second Semester B.E. Degree Examination, June/July 2013
Engineering Physics

Time: 3 hrs.   Max. Marks:100

Note: 1. *Answer any FIVE full questions, choosing at least two from each part.*
2. *Answer all objective type questions only on OMR sheet page 5 of the answer booklet.*
3. *Answer to objective type questions on sheets other than OMR will not be valued.*
4. *Physical Constants :*   *Planck's constant, h = 6.63×10^{-34} Js, Electron charge, e = 1.6×10^{-19} C*
        Electron mass, m = 9.11×10^{-31} kg,   Velocity of light, C = 3×10^8 mS^{-1}
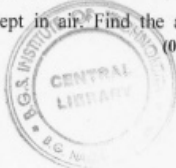
PART – A

1 a. Choose the correct answers for the following :   **(04 Marks)**
   i)   If red and blue stars emits radiations of continuous wavelengths, then according to Wien's displacement law.
        A) Blue star is hotter than red star   B) Red star is hotter than blue star
        C) Both stars are at same temperature   D) Difficult to conclude.
   ii) The expression for de-Broglie wavelength for an electron under an accelerating potential V is,
        A) $\dfrac{12.26}{\sqrt{V}}$ m   B) $\dfrac{12.26}{\sqrt{V}}$ A°   C) $\dfrac{12.26}{\sqrt{V}}$ nm   D) $\dfrac{12.26}{\sqrt{V}}$ μm
   iii) A particle moves with velocity 3×10^6 ms^{-1}. The wavelength associated with it is 1 nm. Then group velocity of the particle is,
        A) 3×10^8 mS^{-1} B) 3×10^{10} mS^{-1} C) 3×10^6 mS^{-1} D) 1.5×10^6 mS^{-1}
   iv) According to the Compton effect, the wavelength of X-rays scattered at an angle greater than zero,
        A) Decreases   B) Doesn't change   C) Increases   D) None of these
   b. Derive an expression for group velocity on the basis of superposition of waves. Also obtain the relation between group velocity and phase velocity.   **(08 Marks)**
   c. Show that Planck's law reduces to Wien's law and Rayleigh-Jeans law under certain conditions.   **(05 Marks)**
   d. Calculate the de-Broglie wavelength associated with an electron of energy 1.5 eV.   **(03 Marks)**

2 a. Choose the correct answers for the following :   **(04 Marks)**
   i)   The energy of the lowest state in one dimensional potential box of length a = 1 unit, is,
        A) $\dfrac{h^2}{8m}$ B) zero   C) $\dfrac{h^2}{4ma^2}$ D) $\dfrac{h^2}{2ma^2}$
   ii) For a particle which is not bound to any system and is free, the energy eigen value is,
        A) zero   B) finite but not quantized
        C) infinity   D) finite but quantized
   iii) If the uncertainty in the position of a particle is equal to its de-Broglie wavelength then uncertainty in its momentum will be,
        A) $\Delta P \geq \dfrac{h}{4\pi}$ B) $\Delta P \geq \dfrac{h}{2\pi}$ C) $\Delta P \geq \dfrac{P}{4\pi}$ D) $\Delta P \geq \dfrac{h}{P}$
   iv) For an electron to be present inside the nucleus of an atom the uncertainty in the position of the electron must be,
        A) more than or equal to the radius of the nucleus
        B) more than or equal to the diameter of the nucleus.
        C) more than the diameter of the nucleus
        D) less than or equal to the diameter of the nucleus.

2 b. Using time independent Schrodinger's wave equation, obtain the expression for the normalized wave function for a particle in one dimensional potential well of infinite height.

(08 Marks)

c. State Heisenberg's uncertainty principle. Write its physical significance. **(04 Marks)**

d. A spectral line of wavelength 5461 Å has a width of 10^{-4} Å. Evaluate the minimum time spent by the electrons in the upper energy state. **(04 Marks)**

3 a. Choose the correct answers for the following : **(04 Marks)**
   i) In the following the ohm's law is,

   A) $J = \sigma E$ B) $J = \dfrac{\sigma}{E}$ C) $J = \sigma E^2$ D) $J = \dfrac{E}{\sigma}$

   ii) Mobility of electron is,
   A) Reciprocal of conductivity
   B) Average electrons drift velocity per unit electric field.
   C) Flow of electrons per unit cross sectional area.
   D) Reciprocal of resistivity

   iii) The dependence of mean free path λ on temperature T is,

   A) $\lambda \alpha T$ B) $\lambda \alpha \sqrt{T}$ C) $\lambda \alpha \dfrac{1}{T}$ D) $\lambda \alpha \dfrac{1}{\sqrt{T}}$

   iv) According to free electron theory, the free electrons are treated as,
   A) Rigidity fixed lattice points   B) Liquid molecules
   C) Gas molecule   D) None of these

b. Define Fermi energy and Fermi factor. Discuss the variation of fermifactor with temperature and energy. **(08 Marks)**

c. What is mean collision time? Using free electron theory in a metal, obtain an expression for electrical conductivity in terms of mean collision time. **(06 Marks)**

d. State and explain Matthiessen's rule. **(02 Marks)**

4 a. Choose the correct answers for the following : **(04 Marks)**
   i) Electronic polarization,
   A) Independent of temperature   B) Increases with temperature
   C) Decreases with temperature   D) None of these

   ii) The correct relation among the following 4 equations is,
   A) $E = \varepsilon_0(\varepsilon_r - 1)P$ B) $P = \varepsilon_0(\varepsilon_r - 1)E$ C) $\varepsilon_r = \chi - 1$ D) $D = \varepsilon_0(\varepsilon_r - 1)E$

   iii) For Ferromagnetic substances, the Curie-Wiess law is given as,

   A) $\epsilon_r = \dfrac{C}{T}$ B) $\epsilon_r = \dfrac{T-\theta}{C}$ C) $\epsilon_r = \dfrac{C}{(T-\theta)}$ D) $\epsilon_r = \dfrac{C}{(T+\theta)}$

   iv) In the inverse piezoelectric effect,
   A) Ultrasonic waves are produced   B) Electromagnetic waves are produced
   C) Microwaves are produced   D) None of these

b. What is internal field? Derive an expression for internal field in case of one dimensional array of atoms in dielectric solids. **(08 Marks)**

c. Describe magnetic hysteresis in Ferromagnetic material. **(05 Marks)**

d. Explain any three applications of piezoelectric material. **(03 Marks)**

PART – B

5 a. Choose the correct answers for the following : **(04 Marks)**

   i) The pumping action in diode laser is by,

     A) Optical pumping B) Electrical discharge C) Reverse bias D) Forward bias

   ii) The expression for energy density in terms of Einstein's coefficients,

    A) $U_\gamma = \dfrac{B}{A}\left[\dfrac{1}{e^{h\gamma/KT}-1}\right]$
          B) $U_\gamma = \dfrac{A}{B}\left[\dfrac{1}{1-e^{h\gamma/KT}}\right]$

    C) $U_\gamma = \dfrac{A}{B}\left[\dfrac{1}{e^{h\gamma/KT}-1}\right]$
          D) $U_\gamma = \dfrac{A}{B}\left[e^{h\gamma/KT}-1\right]$

   iii) In order to see the image of an object recorded by holography.

     A) It is enough if we just have the hologram.

     B) We need the hologram and the reference beam.

     C) We need the hologram, the reference beam and the object beam.

     D) We need the hologram, the reference beam and the object beam as well as the object.

   iv) In a laser system when the energy difference between two energy levels is 2×10^{-19} J, the average power output of laser beam is found to be 4 mw. Then number of Photons emitted per second is,

     A) 2×10^{16}
        B) 2×10^{-16}
        C) 0.5×10^{16}
        D) 2×10^{19}

  b. Describe the construction of He-Ne laser and explain its working with the help of energy level diagram and mention few applications. **(08 Marks)**

  c. Explain the terms spontaneous emission and stimulated emission. **(04 Marks)**

  d. Explain laser welding and cutting process with diagrams. **(04 Marks)**

6 a. Choose the correct answers for the following : **(04 Marks)**

   i) Superconductors are

     A) Ferromagnetic B) Paramagnetic C) Antiferromagnetic D) Diamagnetic

   ii) All high temperature superconductors are different types of oxides of,

     A) Mercury   B) Lead   C) Copper   D) Tin

   iii) The quantum of magnetic flux is given by,

     A) $\dfrac{2e}{h}$ B) $\dfrac{h}{2e}$ C) $\dfrac{he}{2}$ D) $\dfrac{2h}{e}$

   iv) Numerical aperture of an optical fiber depends on,

     A) Acceptance angle B) Diameter of the fiber C) Critical angle D) None of these

  b. Discuss point to point optical fiber communication system and mention its advantages over the conventional communication systems. **(06 Marks)**

  c. Define superconductivity and explain Type I and Type II superconductors. **(06 Marks)**

  d. The angle of acceptance of an optical fiber is 30° when kept in air. Find the angle of acceptance when it is in a medium of refractive index 1.33. **(04 Marks)**

7 a. Choose the correct answers for the following : (04 Marks)
   i) A crystal of hexagonal lattice has unit cell with sides,
       A) $a \neq b \neq c, \alpha = \beta = 90°, \gamma = 120°$ B) $a = b = c, \alpha = \beta = 90°, \gamma = 120°$
       C) $a \neq b = c, \alpha = \beta = \gamma = 90°$ D) $a = b \neq c, \alpha = \beta = 90°, \gamma = 120°$
   ii) In Bragg's spectrometer, for every rotation θ of the turn table, the detector turns by an angle,
       A) θ B) 4θ C) 2θ D) $\frac{\theta}{2}$
   iii) The interatomic distance between the sodium and chlorine atoms in sodium crystal is,
       A) 5.68 Å B) 2.81 Å C) 6.62 Å D) 5.51 Å
   iv) The interplanar spacing in a crystal is 1 Å and the glancing angle is 35°. For the first order Bragg reflection to take place, the wavelength of X-rays is,
       A) 1.147 Å B) 0.573 Å C) 1.638 Å D) 0.819 Å
   b. What are Miller indices? Explain the procedure to find Miller indices with an example. (05 Marks)
   c. Obtain the expression for interplanar spacing interms of 'a' for a cubic lattice. (05 Marks)
   d. Calculate the atomic packing factor for SC, FCC and BCC lattices. (06 Marks)

8 a. Choose the correct answers for the following : (04 Marks)
   i) An acoustic grating can be made by,
       A) Drawing lines on a glass plate
       B) Subjecting an optical grating to pressure waves of ultrasonic frequency
       C) It is only theoretical concept.
       D) Setting up a standing waves pattern in a liquid using ultrasonic.
   ii) The velocity of ultrasonic wave through the liquid increases as,
       A) Bulk modulus decreases B) Density decreases
       C) Bulk modulus increases D) Volume increases
   iii) The minimum size of matter below which the properties becomes size dependent is called,
       A) Pico size B) Nano size C) Micro size D) Macro size
   iv) The number of carbon atoms present in C_{60} molecule is,
       A) 60 B) 32 C) 20 D) 12
   b. Describe with simple illustrations, the two methods of preparation of nano materials. (06 Marks)
   c. Describe a method of measuring velocity of ultrasonic waves in solids. Using this how you can find the rigidity modulus of the solid. (06 Marks)
   d. Explain quantum structures. (04 Marks)

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USN | | | | | | | | | | 10MAT11

First/Second Semester B.E. Degree Examination, June/July 2013
Engineering Mathematics – I

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing at least two from each part.
   2. Answer all objective type questions only on OMR sheet page 5 of the answer booklet.
   3. Answer to objective type questions on sheets other than OMR will not be valued.

PART – A

1 a. Choose your answers for the following : (04 Marks)
   i) If $y = 3^{5x}$ then y_n is   A) $(3 \log 5)^n e^{5x}$ B) $(5 \log 3)^n e^{5x}$ C) $(5 \log 3)^{-n} e^{5x}$ D) $(5 \log 3)^n e^{-5x}$
   ii) If $y = \cos^2 x$ then y_n is
       A) $2^{n+1} \cos(n\pi/2 + 2x)$ B) $2^{n-1} \cos(n\pi/2 + 2x)$ C) $2^{n-1} \cos(n\pi/2 - 2x)$ D) $2^{n+1} \cos(n\pi/2 - 2x)$
   iii) The Lagrange's mean value theorem for the function $f(x) = e^x$ in the interval [0, 1] is
       A) $C = 0.5413$ B) $C = 2.3$ C) 0.3 D) None of these
   iv) Expansion of $\log(1 + e^x)$ in powers of x is _____.   A) $\log 2 - x/2 + x^2/8 + x^4/192 + \cdots$

B) $\log 2 + x/2 + x^2/8 - x^4/192 + \cdots$ C) $\log 2 + x/2 + x^2/8 + x^4/192 + \cdots$ D) $\log 2 - \dfrac{x}{2} - \dfrac{x^2}{8} - \dfrac{x^4}{192} + \cdots$

   b.   If $y^{1/m} + y^{-1/m} = 2x$ prove that $(x^2 - 1)y_{n+2} + (2n+1)xy_{n+1} + (n^2 - m^2)y_n = 0$.   **(06 Marks)**

   c.   Verify the Rolle's theorem for the functions : $f(x) = e^x(\sin x - \cos x)$ in $(\pi/4, 5\pi/4)$.   **(06 Marks)**

   d.   By using Maclaarin's theorem expand $\log \sec x$ up to the term containing x^6.   **(04 Marks)**

2   a.   Choose your answers for the following :   **(04 Marks)**

     i)   The indeterminate form of $\lim\limits_{x \to 0} \dfrac{a^x - b^x}{x}$ is   A) $\log(b/a)$ B) $\log(a/b)$ C) 1   D) -1

     ii)   The angle between the radius vector and the tangent for the curves $r = a(1 - \cos\theta)$ is

       A) $\theta/2$ B) $-\theta/2$ C) $\pi/2 + \theta$ D) $\pi/2 - \theta/2$.

     iii)   The polar form of a curve is _____   A) $r = f(\theta)$ B) $\theta = f(y)$ C) $r = f(x)$ D) None of these

     iv) The rate at which the curve is bending called ____. A) Radius of curvature; B)Curvature; C) Circle of curvature; D) Evaluate.

   b.   Evaluate $\lim\limits_{x \to 0} \left(\dfrac{\sin x}{x} \right)^{1/x^2}$.   **(06 Marks)**

   c.   Find the angles of intersection of the following pairs of curves, $r = a\theta/(1+\theta)$; $r = a/(1+\theta^2)$.   **(06 Marks)**

   d.   Find the radius of curvature at $(3a/2, \ 3a/2)$ on $x^3 + y^3 = 3axy$.   **(04 Marks)**

3   a.   Choose your answers for the following :   **(04 Marks)**

     i)   If $u = x^2 + y^2$ then $(\partial^2 u)/(\partial x \partial y)$ is equal to   A) 2   B) 0   C) $2x$ D) $2y$

     ii)   If $z = f(x, y)$ where $x = u - v$ and $y = uv$ then $(u + v)(\partial z/\partial x)$ is

       A) $u(\partial z/\partial u) - v(\partial z/\partial v)$ B) $u(\partial z/\partial u) + v(\partial z/\partial v)$ C) $\partial z/\partial u + \partial z/\partial v$ D) $\partial z/\partial u - \partial z/\partial v$

     iii)   If $x = r\cos\theta$, $y = r\sin\theta$ then $[\partial(r, \theta)]/[\partial(x, y)]$ is   A) r B) $1/r$ C) 1   D) -1

     iv)   In errors and approximations $\partial x/x$. $\partial y/y$, $\partial f/f$ are called

       A) relative error   B) percentage error   C) error in x, y and f   D) none of these

   b.   If $x^x y^y z^z = c$, show that $\partial^2 z/\partial x \partial y = -[x \log ex]^{-1}$, when $x = y = z$.   **(06 Marks)**

   c.   Obtain the Jacobian of $\partial(x, y, z)/\partial(r, \theta, \phi)$ for change of coordinate from three dimensional Cartesian coordinates to spherical polar coordinates.   **(06 Marks)**

   d.   In estimating the cost of a pile of bricks measured as $2m \times 15m \times 1.2m$, the tape is stretched $+1\%$ beyond the standard length. If the count is 450 bricks to 1 cu.cm and bricks cost of 530 per 1000, find the approximate error in the cost.   **(04 Marks)**

4   a.   Choose your answers for the following :   **(04 Marks)**

     i)   If $\vec{R} = xi + yj + zk$ then div $\vec{R}$ A) 0   B) 3   C) -3 D) 2

     ii)   If $\vec{F} = 3x^2 i - xyj + (a-3)xz\,k$ is Solenoidal then a is equal to ____   A) 0   B) -2 C) 2   D) 3

     iii)   If $\vec{F} = (x + y + 1)i + j - (x + y)k$ then $\vec{F} \cdot \text{curl} \vec{F}$ is ___.   A) 0   B) $x + y$ C) $x + y + z$ D) $x - y$

     iv)   The scale factors for cylindrical coordinate system (ρ, ϕ, z) are given by

       A) $(\rho, 1, 1)$ B) $(1, \rho, 1)$ C) $(1, 1, \rho)$ D) none of these

   b.   Prove that $\text{curl}\overline{A} = g\,\text{rad}(\text{div}\overline{A}) - \nabla^2 A$.   **(06 Marks)**

   c.   Find the constants a, b, c such that the vector $\overline{F} = (x + y + az)i + (bx + 2y - z)j + (x + cy + 2z)k$ is irrotational.   **(06 Marks)**

   d.   Derive an expression for $\nabla \cdot \overline{A}$ in orthogonal curvilinear coordinates. Deduce $\nabla \cdot \overline{A}$ is rectangular coordinates.   **(04 Marks)**

PART – B   **10MAT11**

5   a.   Choose your answers for the following :   **(04 Marks)**

     i)   The value of $\int_0^\infty e^{-\alpha x} dx$ is _____   A) $1/e$ B) $-1/e$ C) $1/\alpha$ D) $-1/\alpha$

     ii)   The value of the integral $\int_0^{\pi/2} \sin^7 x\,dx$ is   A) $35/16$ B) $16/35$ C) $-16/35$ D) $18/35$

     iii)   The volume generated by revolving the cardioid $r = a(1 + \cos\theta)$ about the initial line is

       A) $(3\pi a^2)/8$ B) $(3\pi a^3)/8$ C) $(2\pi a^2)/9$ D) None

     iv)   The area of the loop of the curve $r = a\sin 3\theta$ is ____   A) $a^2/12$; B) $\pi/12$;   C) $\pi a^2/12$; D) None

   b.   By applying differential under the integral sign evaluate $\int_0^{\pi/2} \dfrac{\log(1 + y\sin^2 x)}{\sin^2 x} dx$.   **(06 Marks)**

c. Evaluate of $\int_0^{} \sin^n x \, dx$ where n is any integer. **(06 Marks)**

d. Find the length of the arch of the cycloid $x = a(\theta - \sin\theta)$; $y = a(1 - \cos\theta)$; $0 < \theta \leq 2\pi$. **(04 Marks)**

6 a. Choose your answers for the following : **(04 Marks)**

    i) The general solution of the differential equation $(dy/dx) = (y/x) + \tan(y/x)$ is

        A) $\sin(y/x) = c$ B) $\sin(y/x) = cx$ C) $\cos(y/x) = cx$ D) $\cos(y/x) = c$

    ii) An integrating factor for $ydx - xdy = 0$ is   A) x/y B) y/x C) $1/(x^2y^2)$ D) $1/(x^2+y^2)$

    iii) The differential equation satisfying the relation $x = A\cos(mt - \alpha)$ is

        A) $(dx/dt) = 1 - x^2$ B) $(d^2x/dt^2) = -\alpha^2 x$ C) $(d^2x/dt^2) = -m^2x$ D) $(dx/dt) = -m^2x$

    iv) The orthogonal trajectories of the system given by $r = a\theta$ is

        A) $r^2 = ke^\theta$ B) $r = ke^\theta$ C) $r^2 e^{-\theta^2} = k$ D) $r^2 = k \, e^{-\theta^2}$

b. Solve $(x\cos(y/x) + y\sin(y/x))y - (y\sin(y/x) - x\cos(y/x)) \, x \, (dy/dx) = 0$. **(06 Marks)**

c. Solve $(1 + y^2) + (x - e^{\tan^{-1}y})dy/dx = 0$. **(06 Marks)**

d. Prove that the system of parabola $y^2 = 4a(x + a)$ is self orthogonal. **(04 Marks)**

7 a. Choose your answers for the following : **(04 Marks)**

    i) Find the rank of $\begin{bmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & 2 \end{bmatrix}$:   A) 3   B) 2   C) 4   D) 1

    ii) The exact solution of the system of equation $10x + y + z = 12$, $x + 10y + z = 12$, $x + y + 10z = 12$ by inspection is equal to   A) $(-1, 1, 1)$;   B) $(1, 1, 1)$;   C) $(-1, -1, -1)$;   D) None

    iii) If the given system of linear equations in 'n' variables is consistent then the number of linearly independent – solution is given by   A) n ;   B) $n - 1$;   C) $r - n$;   D) $n - r$

    iv) The trivial solution for the given system of equations $9x - y + 4z = 0$, $4x - 2y + 3z = 0$, $5x + y - 6z = 0$ is

        A) $(1, 2, 0)$ B) $(0, 4, 1)$ C) $(0, 0, 0)$ D) $(1, -5, 0)$.

b. Using elementary transformation reduce each of following matrices to the normal form, $\begin{bmatrix} 1 & 1 & 1 & 6 \\ 1 & -1 & 2 & 5 \\ 3 & 1 & 1 & 8 \\ 2 & -2 & 3 & 7 \end{bmatrix}$. **(06 Marks)**

c. Test for consistency and solve the system, $2x + y + z = 10$, $3x + 2y + 3z = 18$, $x + 4y + 9z = 16$. **(06 Marks)**

d. Apply Gauss-Jordan method to solve the system of equations, $2x + 5y + 7z = 52$, $2x + y - z = 0$, $x + y + z = 9$ **(04 Marks)**

8 a. Choose your answers for the following : **(04 Marks)**

    i) A square matrix A is called orthogonal if,   A) $A = A^2$ B) $A = A^{-1}$ C) $AA^{-1} = I$ D) None

    ii) The eigen values of the matrix, $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ are   A) $2, 3, 8$ B) $2, 3, 9$ C) $2, 2, 8$ D) None

    iii) The eigen vector X of the matrix A corresponding to eigen value λ and satisfy the equation,

        A) $AX = \lambda X$ B) $\lambda(A - X) = 0$ C) $XA - A\lambda = 0$ D) $|A - \lambda I|X = 0$

    iv) Two square matrices A and B are similar if,   A) $A = B$;   B) $B = P^{-1}AP$;   C) $A' = B'$;   D) $A^{-1} = B^{-1}$

b. Show that the transformation, $y_1 = 2x_1 - 2x_2 - x_3$, $y_2 = -4x_1 + 5x_2 + 3x_3$, $y_3 = x_1 - x_2 - x_3$ is, regular and find the inverse transformations. **(06 Marks)**

c. Diagonalize the matrix, $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$. **(06 Marks)**

d. Reduce the quadratic form, $x_1^2 + 2x_2^2 - 7x_3^2 - 4x_1x_2 + 8x_2x_3$ into sum of squares. **(04 Marks)**

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Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs.   Max. Marks:100

Note: 1. *Answer any FIVE full questions, choosing at least two from each part.*
2. *Answer all objective type questions only on OMR sheet page 5 of the answer booklet.*
3. *Answer to objective type questions on sheets other than OMR will not be valued.*
4. *Assume missing data suitably.*

PART – A

1 a. Choose the correct answers for the following :   **(04 Marks)**
   i)   Geotechnical engineering involves the study of,
        A) Water   B) Soil   C) Air   D) All of these
   ii) By-pass road is constructed,
        A) Inside the city   B) Over the main road
        C) Around the city   D) None of these
   iii) The part of civil engineering which deals with waste water and solid waste is called,
        A) Water supply engineering   B) Geotechnical engineering
        C) Sanitary engineering   D) Structural engineering
   iv) A bascule bridge is a,
        A) Floating bridge   B) Arch bridge   C) Suspension bridge   D) Movable bridge
   b. Write a note on role of civil engineer in infrastructural development.   **(10 Marks)**
   c. Name the different types of roads as per Nagpur plan.   **(06 Marks)**

2 a. Choose the correct answers for the following :   **(04 Marks)**
   i)   Moment of a force can be defined as the product of force and _____ distance from
        the line of action of force to the moment center.
        A) Least   B) Maximum   C) Any   D) None of these
   ii) Effect of force on a body depends on,
        A) Direction   B) Magnitude   C) Position   D) All of these
   iii) The forces which meet at one point have their line of action in different plane are
        called,
        A) Coplanar concurrent forces   B) Non coplanar concurrent forces
        C) Non coplanar non concurrent forces D) None of these
   iv) Couple means two forces acting parallel,
        A) Equal in magnitude and in the same direction.
        B) Not equal in magnitude but in the same direction.
        C) Equal in magnitude but opposite in direction.
        D) None of these
   b. Define force and state its characteristics.   **(06 Marks)**
   c. Determine the magnitude and direction of the resultant for the system of forces shown in
      Fig. Q2 (c). Use classical method.   **(10 Marks)**

Fig. Q2 (c)

3 a. Choose the correct answers for the following : (04 Marks)
   i) The technology of finding the resultant of a system of forces is called,
      A) Resultant   B) Resolution   C) Composition   D) None of these
   ii) Equilibriant in nothing but a resultant,
      A) Equal in magnitude and in the same direction.
      B) Equal in magnitude but opposite in direction.
      C) Not equal in magnitude but in the same direction.
      D) Not equal in magnitude and opposite in direction.
   iii) If two forces P and Q (P > Q) act on the same straight line but in opposite direction their resultant is
      A) P + Q   B) P/Q   C) Q – P   D) P – Q
   iv) In coplanar concurrent force system if $\Sigma H = 0$ then the resultant is
      A) Horizontal   B) Vertical   C) Moment   D) None of these
   b. State and prove Varignon's theorem of the moments. (06 Marks)
   c. Two spheres each of radius 100mm and weight 5kN is in a rectangular box as shown in Fig. Q3 (c). Calculate the reactions at the point of contacts. (10 Marks)
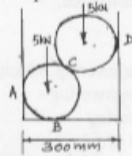
Fig. Q3 (c)

4 a. Choose the correct answers for the following : (04 Marks)
   i) Moment of total area about its centroidal axis is
      A) Twice the area   B) Three times the area   C) Zero   D) None of these
   ii) The centroid of a semicircle of radius R about its centroidal axis parallel to its diametric axis is
      A) $3R/4\pi$ B) $3R/8\pi$ C) $4R/\pi$ D) $4R/3\pi$
   iii) An axis over which one half of the plane figure is just mirror of the other half which is
      A) Bottom most axis of the figure   B) Axis of symmetry
      C) Unsymmetrical axis   D) None of these
   iv) Centroid of a rectangle of base width b and depth d is
      A) b/3 and d/3   B) b/2 and d/2   C) b/4 and d/4   D) None of these.
   b. Determine the centroid of a triangle by the method of integration. (06 Marks)
   c. Locate the centroid of the lamina shown in Fig. Q4 (c) with respect to point 0. (10 Marks)
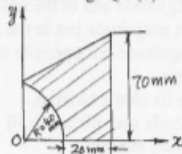
Fig. Q4 (c)

PART – B

5 a. Choose the correct answers for the following : (04 Marks)
   i) The necessary condition of equilibrium of a coplanar concurrent force system is algebric sum of _____ must be zero.
      A) Horizontal and vertical forces   B) Moment of forces
      C) Horizontal, vertical and moment of forces   D) None of these

7   a.   Choose the correct answers for the following :   (04 Marks)
     i)   Angle of friction is angle between
          A) the incline and horizontal
          B) the normal reaction and friction force
          C) the weight of the body and the friction force
          D) Normal reaction and the resultant.
     ii)   The force of friction developed at the contact surface is always
          A) Parallel to the plane and along the direction of the applied force
          B) Perpendicular to the plane
          C) Parallel to the plane and opposite to the direction of the motion
          D) All of these.
     iii) The maximum inclination of the plane on which the body free from external forces
          can repose is called
          A) Cone of friction   B) Angle of friction   C) Angle of repose   D) None of these
     iv)   The force of friction depends on
          A) Area of contact
          B) Roughness of the surface
          C) Both area of contact and roughness of the surface
          D) None of these.
    b.   State the laws of static friction.   (04 Marks)
    c.   A uniform ladder of length 15m and weight 750N rests against a vertical wall making an
          angle of 60° with the horizontal. Co-efficient of friction between the wall and the ladder is
          0.3 and between the ground and the ladder is 0.25. A man weighing 500N ascends the
          ladder. How long will he be able to go before the ladder slips?   (12 Marks)

8   a.   Choose the correct answers for the following :   (04 Marks)
     i)   The unit of radius of Gyration is
          A) mm   B) mm^2 C) mm^3 D) mm^4
     ii)   The moment of inertia of an area about an axis which is in a plane perpendicular to the
          area is called
          A) Radius of Gyration   B) Polar moment of inertia
          C) Second moment of area   D) None of these
     iii) The moment of inertia of a circle with 'd' as its diameter about its centroidal axis
          A) $\pi D^2/32$ B) $\pi D^2/64$ C) $\pi D^4/32$ D) $\pi D^4/64$
     iv)   The moment of inertia of a square of side 'b' about an axis through its centroid is
          A) $b^4/12$ B) $b^4/8$ C) $b^4/36$ D) $b^3/12$
    b.   State and prove parallel axis theorem.   (06 Marks)
    c.   Find the moment of inertia of the region shown in Fig. Q8 (c) about horizontal axis AB and
          also find the radius of Gyration about the same axis.   (10 Marks)

All dimensions are in mm

Fig. Q8 (c)

* * * * *

5a. t0Blrtlrt4t24 PART-B Choose the coffect answers for the following : (04 Marfuq) i) Compound side swiveling method is u...

:]lE .T toEi$trEt4t24 (04 Marks) ., i) Spelter is used ir1 Ay," A) Welding '(Ot c) Soldering '-/)l ii) - is usedii) - is u...

USN 10ELE15/2s D) Kirchhoffs law (05 Marks) iii) the equivalent (06 Marks) c. d. o. E ! 2 fs = v') --t drq u= boc .].o) 5!...

a. Choose the comect answers for the following : i) The law that hnds application in electrolysis 10ELEt5/25 (04 Marks) A)...

10ELE15/25 iv) Three equal impedances are t-rst connected in delta across a 3 - phase balanced supply. Ilthe same impedanc...

1oELE15/25 7 a. Choose corect answers for the following : (04 Marks) i) In a synchronous machine, the stator frame is made...

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Transcript of "1st semester Physics stream (2013-June) Question Papers "

1. 1. USN IOPHYt2t22 Degree Examination, June/July 2013First/Second Semester B.E. .9 I -9 E ;) =^-: .: ei 9! 'E '== i !a :E =+ = _9 -^o 6= E11 o< a z ag E t-', 16 12.26 12.26 B) --: A" f1 _:l nm Dt _:3 p6 Jv Jv Jv with velocity 3 x 106 ms-r. The wavelength associated with it is B) Doesn't change C) Increases h2 A)_8m B) zero c) h'. 4ma' D) ht. ' 2ma' iD For a particle which is not bound to any system and is free, the energy eigen value is, A) zero B) finite but not quantized C) infinity D) finite but quantized iii) Ilthe uncertainty in the position ofa particle is equal to its de-Broglie wavelength then uncertainty in its momentum will be, A) ^P > -]LA- B) ^P > -ll-'2n c) ir) For an electron to be present inside the nucleus AP>l4n of an atom the D)AP>h uncertainty in the position ofthe electron must be, A) more than or equal to the radius ofthe nucleus B) more than or equal to the diameter ofthe nucleus. C) more than the diameter ofthe nucleus D) less than or equal to the diameter ofthe nucleus. I ol4 Engineering Physics Time: 3 hrs. Max. Marks:100 Notei l. Answer any Fl VE full questions, choosing at le6t tteo fiom each pafi 2. Answer all objective type questions onllt on OMR sheet page 5 ofthe answer booklet. 3. Answer to objective tlpe questions on sheets other than OMR will not be valued. 4. Physicat Constants: Planck's constaftt, n= 6.63 x10-34 Js, Electroncharge,e:1.6x10-reC Electron mass, m= 9.llxlO 31 kg, Vetocit! o.f light, C= 3x108rz,s/ PART-A I a. Choose the correct answers lbr the following : (04 Marks) i) If red and blue stars emits radiations of continuous wavelengths, then according to Wien's displacement law. A) Blue star is hotter than red star B) Red star is hotter than blue star C) Both stars.are at same temperaJure D) Difficult to conclude. iD The expression for de-Broglie wavelength for an electron under an accelerating potential V is, 12.26 A) -ma/V iii) A particle moves 1 nm. Then group velocity ofthe particle is, A) 3x108 mS-r B) 3x10'0 mS'r C) 3x106 mS-r D) l.5x106 mS-r i r) According to the Compton effect, the wavelength of X-rays scattered at an angle greater than zero, A) Decreases D) None of these b. Derive an expression for grgup velocity on the basis of superposition of waves. Also obtain the relation between group velocity and phase velocity. (08 Marks) c. Show that Planck's law reduces to Wien's law and Rayleigh-

Jeans law under certain conditions. (05 Marks) d. Calculate the de-Broglie wavelength associated with an electron of energy 1 .5 eV. (0J Marks) 2 a. Choose the correct answers for the following : (04 Marks) i) The energy ofthe lowest state in one dimensional potential box oflength a: 1 unit is,

2. 2. c. State Heisenberg's uncertainty principle. Write its physical significance. d. A spectral line of wavelength 5461 Ahas a width of 10{A. Evaluate spent by the electrons in the upper energy state. 3 a. Choose the correct answers for the following : i) In the following the ohm's law is, 10P}IY12/22 b. Using time independent Schrodinger's wave equation, obtain the expression for the normalized wave function for a particle in one dimensional potential well of infinite height. (0E Marks) (0,t Marks) the minimum time (04 Marks) (0,1 Marks) B) J=; iil Mobility of electron is, A) Reciprocal of conductivity B) Average electrons drift velocity per unit electric field. C) Flow ofelectons per unit cross sectional area. D) Reciprocal ofresist ivity iii) The dependence ofmean free path 1. on temperature T is, A) J=oE C) J=oE'? q),cr+ D) l.cr B) Increases with temperature D) None ofthese D) J= E 6 (06 Marks) (02 Marks) (04 Marks) D) D=eo(e. -1)E D) e, 1 tiv) According to free electron theory, the free electrons are treated as, A) Rigidity fixed lattice points , B) Liquid molecules C) Gas molecule D) None of these b. Define Fermi energy and Fermi factor. Discuss the variation of fermifactor with temperature and energy. (08 Marks) c. What is mean collision time? Using free electron theory in a metal, obtain an expression for A) l.crT B)).oJT electrical conductivity in terms of mean collision time. d. State and explain Matthiessen's rule. a. Choose the correct answers for the following : i) Electronicpolarization, A) Independent of temperature C) Decreases with temperature ii) The correct relation among the following 4 equations is, A) E=eo(e.-l)P B) P=eo(e, -1)E C) e.=1-1 iii) For Ferromagnetic substances, the Curie-Wiess law is given as, A)..=; B).,=T c) e,= (r-0) iv) In the inverse piezoelectric effect, A) Ultrasonic waves are produced B) Electromagnetic waves are produced C) Microwaves are produced D) None of these b. What is internal field? Derive an expression for internal field in case of one dimensional array of atoms in dielectric solids. (08 Marks) c. Describe magnetic hysteresis in Ferromagnetic material. (05 Marks) d. Explain any three applications ofpiezoelectric material. (03 Marks) 2of4

3. 3. PART _ B 5 a. Choose the correct answers for the following : i) The pumping action in diode laser is by, b. c. d. c. d. A) Optical pumping B) Electrical discharge C) Reverse bias D) Forward bias iD The expression for energy density in terms ofEinstein's coeffrcients, A)u=gl 'l' oLrn'*'-'l ""'=+l'=liiD In order to see the image ofan object recorded by holography. A) It is enough if we just have the hologram. B) We need the hologram and the reference beam. C) We need the ho logram, the reference beam and the object beam. D) We need the hologram, the reference beam and the object beam as well as the object. iv) In a laser system when the energy difference between two energy levels is 2xl}-te J, the average power output oflaser beam is found to be 4 mw. Then number ofPhotons emitted per second is. A) 2xl0r6 B) 2x10'u C) 0.5x10r6 D) 2x10"q Describe the construction of He-Ne laser and explain its working with the help of energy level diagram and mention few applications. (08 Marks) Explain the terms spontaneous emission and stimulated emission. (04 Marks) Explain laser welding and cutting process with diagranrs. (04 Marks) I0PIIYt2l22 (04 Marks) (06 Marks) (06 Marks) D) ri = Al"hvKr -rllBL] 6 a. Choose the correct answers for the following : , (04 Marks) i) Superconductors are A) Ferromagnetic B) Paramagnetic C) Antiferromagnetic D) Diamagnetic ii) All high temperature superconductors are different types ofoxides of, A) Mercury B) Lead C) Copper ii, The quantum of magnetic flux is given by, er 29 B)L cr E h2e2 iv) Numerical apertr.re of an optical fiber depends on, the conventional communication systems. Define superconductivity and explain Tlpe I and Type II superconductors. D) Tin D4e A) Acceptance angle B) Diameter of the fiber C) Critical angle D) None of these b. Discuss point to point optical fiber communication system and mention its advantages over .: ' The angle of acceptance of an optical fiber is 30o when kept in aiffind the angle of acceptance when it is in a medium ofrefiactive index 1.33. (04 Marks) j i:;i , 3 ol4

4. 4. I0PHYt2l22 (04 Marks)7 a. Choose the correct answers for the following : i) A crystal ofhexagonal lattice has unit cell with sides, A) a * b + c, cr =p =90" ,y =120' C) a*b=c,o=B=y=90' B) a = b = c,a = F =90",y =120" D) a - b + c, cr - F -90' , y -120' ii) In Bragg's spectrometer, for every rotation 0 ofthe turn table, the detector turns by an angle, A D):'2 .iii) The interatomic distance between the sodium and chlorine atoms in sodium crystal is, A) 5.68 A B) 2.81 A C) 6.62 A D) s.s1 A iv) The interplanar spacing in a crystal is 1 A and the glancing angle is 35o. For the first order Bragg reflection to take place, the wavelength of X-rays is, A) 1.147 A B) 0.573 A c) 1.638 A D) 0.819 A b. What are Miller indiees? Explain the procedure to find Miller indices with an example. (05 Marks) c. Obtain the expression for interplanar spacing interms of 'a' for a cubic lattice. (05 Marks) d. Calculate the atomic packing factor for SC, FCC and BCC lattices. (06 Marks) 8 a. Choose the correct answers for the following : (04 Marks) i) An acoustic grating can be made by, A) Drawing lines on a glass plate B) Subjecting an optical grating to pressue waves ofultrasonic liequency C) It is only theoretical concept. D) Setting up a standing waves pattern in a liquid using ultrasonic. ii) The velocity of ultrasonic wave through the liquid increases as, A) Bulk modulus decreases B) Density decreases C) Bulk modulus increases D) Volume increases iii) The minimum size of matter below which the properties becomes size dependent is called, A) Pico size B) Nano size C) Micro size D) Macro size D) t2 iv) The number of carbon atoms present in C6s molecule is, A) 60 B) 32 c) 20 b. Describe with simple illustrations, the two methods of preparation of nano materials. c. (06 Marks) waves in solids. Using this how you (06 Marks) (04 Marks)d. A)e B) 4e c) 2e Describe a method of measuring velocity of ultrasonic can find the rigidity modulus of the solid. Explain quantum structures. 4of4

5. 5. USN I TOMATll Time: I hrs A; 2"*r cos(nn/2+2x) ay 2" rcos(nnl2+2x) c) 2n-rcos(nnl2-2x) o1 2"*1 cos(nnl2-zx iii) The Lagrange s me.m value theorem fbr the function f(x) = e' ;n the interval [0. l] is A) C = 0.5413 Il) c: 2.3 C) 0.3 D) None ofthese A)log2-x/2+x:/8+ *a llg2+ *iv) Expansion of log(1 + e*) in porvers ofx is q E-i ot) na i J irr ;6 4tE E>og ?>. ll< rN o z E o 9. tr B)log2+ x/2 + x'?l8 -*a llg2+- C)log2+x/2+x2/8 +*n ll92+ -- 6. tr y';, * y ri, = 2x p,ou" that (x2 - l)y,,*2 +(2n + l)xy"+r + (n2 -m2)y,, = g. c. Verify the Rolle's theorem fbr the firnctions : /(x) = e'(sin r - cos r) in (7.t4,5rta). d. By using Maclaarin's theorem expand log sec x up to the term containing xo . a. Choos( )our anrucrs ti,r rhe lbllor.ing: I he indeterminare form of lim o - " is er log(%) r,0 X a; log(%) c) l D) l Find the angles of intersection of the fbllowing pairs of curves. r = a0 (1 + e) : r = a/(l +02). Find the radius ofcurvature at (3al2, 3a/2 on xr + yr = 3axy. Choose your answers for the following :)), ,^2.,,.ir Il u - - +) - rhen la- u) (aay)iicqucl ro)4 Dllos2 I L-L+ -- ')8t92 ii) I he angle betwcen the radius vector dnd the tangenllbr the curres r = a(l - cos 0) is A) gl2 B) -e/2 Ct rl2+e D rl2-012. iii) The polar tbrm of a curve is A) r=f(0) B) 0=f(y) C) r=f(x) D) None ofthese iv)Therateatwhichthecurveishendingcalled_.A)Radiusofcur,ature:B)Curvature:C)Circleofcurvalure;D)Evaluate. b. fvaluare r i-f :"' t I . (06 Mark) .,ot r,l c. d. 3a. A)2 B)0 C) 2x Dl 2y ii) ll z-f(x,y)where x=u-vand y=uvthen (u+v)(62l6x)is A) u(az / 6u)- v(az / av) B)u(62l6u)+v(dzldv) c) azlAu+Aztdv D1 0z/ Au-OzlAv iii) lf x : r cos 0. y: r sin e then [6(r,0)]/[6(x, y)] is A) r B) lh q 1 D) -l iu) In errors and approximations 6x /x. cly, 6flf are called C) error in x, y and f D) none oftheseA) relative cnor B) percentage error b. lf x*yvz'=c. show that dzl Ax" = - [x logex]r. rvhen x =y= z. (06 Mrrk) c. Obtain the Jacobian ol flx. y. z)/,i(r.0" $) lbr change ol coordinate liom three dimensional Cartesian coordinates to spherical polar coordinates. (06 Mark) ln estimating the cost ofa pile ofbricks measured as 2mx l5mx 1.2m. the tape is stretched + loZ beyond the standard length. Ifthe count is 450 bricks to I cu.cm and bricks cost of 530 per 1000. find the approx imate error in the cost. (0{ Mark) Choose your answers for the following : (04 Marks) ir lfi xi+)j+7k rhendiv i A)0 B)l C) -3 D)2 ii) llF 3xri-xyj+{a-3rrzk is Solenoidal thenaisequal to A)0 B)-2 C) 2',p)l1 iii) If F = (x + y + l)i+.i- (x + y)k then F.curlF is A) 0 B) x+y Ci x+y+z D),ily iv)ThescaletbctorsfbrcylindricalcoordinateSyStem(p,$,z)aregivenby A) (p, l, l) B) (1, p, 1) C) (1, l, p) ' ;'.. D) none ofthese Prove that curlA = g rad(divA)-V2A. (06 Mrrk) Find the constants a, b, c such that the vqcler I = 1x +y+az)i+(bx + 2y-z)j+ (x+cy + Zz)k is irotational. (06 Mnrk) Derive an expression for V . A in orthogonal curvilinear coordinates. Deduce V .A is rectangular coordinates. t ot2 (04 M'rkr) b. c. First/Second Semester B.E. Degree Examination, June/July 2013 Engineering Mathematics - I Max. Marks: 100 Notei l. Answet an! FIVE lull queslions, choosing al leasl tt ofrorfi each pfil. 2. Answet all objective lype q esliohs onb) ot, OMR sheet page 5 oflhe answer booklel 3. Answer to objecrive 41pe quesliotts ol sheels olher thort OMR wil ,rot be rolued PART _ A a. Choose vour answers for the follou'rnp : l) ir) = J- then yn rs ii) If y = cg52 x then yn is e) (: log s)'e5- (04 Marks) ay (s tog3)" e5- cy (stog3)-"e5' oy(slog:)e-5- (06 Marks) (06 Marks) (04 Marks) (04 Marks) (06 Mark) (04 Marks) (04 Mark)

6. 6. iii) The volume generated by revolving the cardioid r = a(l + cos 0) about the initial line is A) (3?ra'?) / 8 B) (3?ra3) / 8 c) (2na'?) I 9 D) None iv) The area ofthe loop ofthe curve r = a sin 30 is A) a2 /12 ; B) n/12 C) na1/t2 ; PART - B Choose your answers for the following : i) The ralue of '1',-".r, is A) I'e J' -- nl2 ii) The ralue ofthe integral f.i, ^,1^ is A) J5 I6 J 0 IOMATI I (01Mrrks) B) -lle C) lla D) -llc B) 16/3s C)-t6l35 D) 18/35 D) None (06 Msrks)

(06 Mark) (0,1Marks) (04 Marks) D) (dx/dt) : m']x Dlr':k e o' (06 Mark) (06 Marks) (0,1 M:rrk) (04 Mark) B)2 C)4 D)r c. d. 6a. b. c. d. n/1 b. By applying differential under the integral sign evaluate 'l logt I !-).sln : r r o, . o sm'x A) (dx/dt) : I - x2 B) (d']x/dt'?) = o2x c) (d'?x/df) : m'x iv) The orthogonal traiectories ofthe system given by r = a0 is A; rr = keo B)r=keo C)l e o'=t< Solve (x cos(y / x) + ysin(y/ x))y - (ysin(y / x) - x cos(y / x)) x(dy /dx) = 0. sotu. (l * 1=)* (* - "*' '")ay a,,=0. Prove that lhe system ofparabola y - 4a (x + a) is selforthogonal. Choose your answers for the following : .. i) FindLherankof f-'" ,' il' A)3 l-, , ,l c. d. a. find the inverse transform ati on s. lg -t zl Diasonalize the m atrix- ^ | " , I A-l b / -41' l.z -+ :l Reduce the quadratic form, xf +2x?2-7x4 - 4x,x, + 8x rx. into sum ofsquares. 2 oI2 ii) The exact solution ofthe system ofequation lOx+y+z=12,x+ lOy+z=12,x+y+102=12by inspection is equal to A) CI, 1,1); B)(1, 1, 1) ; C)(1,-1,-l); D)None iii) If the given system of linear equations in 'n' variables is consistent then the number of lJnearly independent - solution is given by A)n ; B)n-l ; C)r n ;D)n r iv)Thetrivialsolutionforthegivensystemofequations9x-y+42=0,4x-2y+32:0,5x+y-62:0is A) (r, 2, 0) B) (0, 4, l) c) (0, 0, 0) D) (r, -s,0). [t I I o'l Using elementary transformation reduce each of following matrices to the.normal form. I - t 2 5 . t06 Marks) J I 18 12 _z 31 Test for oonsistency and solve the system, 2x+ y + z:10,3x +2y +32= 18, x + 4y +92=16. (06 Msrks) Apply Gauss-Jordan method to solve the system of equations, 2x+5y+72=52, 2x+y-z=0, x+y+z=g (o,lMark) Choose your answers for the following : (01 Mark) i) A square matrix A iscalled orthogonal if, A) A=A'? B)A=A-r C) AA I=t D)None ii) The eigen values ofthe matrix. f_u. ,t _',l ur. A) 2. 3. 8 B) 2,3,9 C) 2,2, 8 D) None l, -, ,l iii) The eigen vector X ofthe matrix A corresponding to eigen value L and satisfy the equation A) AX:7,x B)).(A x)=0 C) xA-A^=o D) la-r.rlx=o iv) Two square matrices Aand B are similar if, A) A=B; B)B:P-rAP; C)A'=B'; D) Ar=BI Show that the transformation, yr=2x1-2x2 -x3, y2 =-4xl +5x2 +3x3, Yr -xr -x: -x. is, regular and Evaluate of [in " x rix where n is an5 integer. J Findthe lenglh ofthe arch ofthe cycloid x=a(0-sin0); y= a (l - cos0); 0<0 (2r. Choose your answers for the following : i) The general solution ofthe differential equation (dy / dx) = (y / x) + tanly / x) is A) sin (y/x) = c B) sin (y/x) = cx C) cos (y/x) = cx D) cos (y/x) = c ii) An integrating factor for ydx xdy = 0 is A) /y B) y/x C) l(x'?f; D) l/(x']+f; iii) The differential equation satisrying the relation x = A cos (mt - c) is (06 Mrrks) (06 Marks) (04 Marks)

7. 7. o. a 'a ;, ,= a] I ?,- Aor Jdr O; a'; o< :' a z E q Elements of Givil Engineering and Engineering Mechanics Tirre: 3 hrs. Notei l. Answer any Fl VE full questions, choosing at least th'o from each pdrL Max. Marks:100 2. Answer I objective tlpe questions only on OMR sheet page 5 oflhe answer booklet. 3. Answer to objeclive Ope queslions on sheets othet than OMR will not be valued. 4. Assu me missing data suitabl.t. USN First/Second Semester B.E. PART-A I a. Choose the correct answers for the following : i) Geotechnical engineering involves the study of, tDcrY13l23 Degree Examination, June/July 2013 (04 Marks) D) All of these B) Geotechnical engineering D) Structural engineering D) Movable bridge (10 Marks) (06 Marks) (04 Marks) distance from A) Water B) Soil C) Air ii) By-pass road is constructed, A) Inside the city B) Over the main road C) Around the city D) None of these iiD The part of civil engineering which deals with waste water and solid waste is called, A) Water supply engineering C) Sanitary engineering iv) A bascule bridge is a, A) Floating bridge B) Arch bridge C) Suspension bridge b. Write a note on role of civil engineer in infrastructural development. c. Name the different tlpes of roads as per Nagpur plan. 2 a. Choose the correct answers for the following : i) Moment ofa lbrce can be defined as the product of force and the line olaction offorce to the moment center. A) Least 8.1 Maximum C) Any D) None of these ii) Effect offorce on a body depends on, A) Direction B) Magnitude C) Position D) All of these iii) The forces which meet at one point have their line of action in different plane are called, A) Coplanar concurrent forces B) Non coplanar concurrent forces C) Non coplanar non concurrent forces D) None of these ir) Couple means two forces acting parallel, A) Equal in magnitude and in the same direction. B) Not equal in magnitude but in the same direction. C) Equal in magnitude but opposite in direction. D) None of these b. Define force and state its characteristics. (06 Marks) c. Determine the magnitude and direction of the resultant for the system of forces shown in Fig. Q2 (c). Use classical method. (10 Marks) Fig. Q2 (c) 1 of4 I'KN

8. 8. t0crYt3t23 3 a. Choose the correct answers for the following : (04 Marks) i) The technology offinding the resultant ofa system offorces is called, A) Resultant B) Resolution C) Composition D) None of these iD Equilibriant in nothing but a resultant, A) Equal in magnitude and in the same direction. B) Equal in magnitude but opposite in direction. C) Not equal in magnitude but in the same direction. D) Not equal in magnitude and opposite in direction. iii) If two forces P and Q @ > Q) act on the same straight line but their resultant is A) P+Q B)P/Q C)Q P iv) In coplanar concurrent force system ifIH = 0 then the resultant is A) Horizontal B) Vertical C) Moment D) None of these in opposite direction D)P_Q (06 Marks) box as shown in (10 Marks) b. c. State and prove Varignon's theorem ofthe moments. Two spheres each of radius 100mm and weight 5kN is in a rectangular Fig. Q3 (c). Calculate the reactions at the point ofcontacts. Fig. Q3 (c) 4 a. Choose the corect answers for the following : A) Bottom most axis of the figure C) Unsymmetrical axis A) Horizontal and vertical forces C) Horizontal, vertical and moment of forces 2of4 i) Moment of total area about its centroidal axis is A) Twice the area B) Three times the area C) Zero D) None of these ii) The centroid of a semicircle of radius R about its centroidal axis parallel to its diametric a,xis is A) 3R/4n B) 3R/8n C) 4R/n D) 4R/3n iii) An axis over which one half of the plane figure is just mirror of the other half which is (04 Marks) (06 Marks) (10 Marks) iv) Centroid ofa rectangle ofbase width b and depth d is A) b/3 and d/3 B) bl2 and d/2 C) bl4 and dl4 D) None ofthese. B) Axis of symmetry D) None ofJhese B) Moment of forces D) None ofthese b. Determine the centroid of a triangle by the method of integration. c. Locate the centroid of the lamina shown in Fig. Q4 (c) with respect to point 0. Fig. Qa (c) PART - B 5 a. Choose the correct answers for the following : (04 Marks) i) The necessary condition of equilibrium of a coplanar concurrent force system is algebric sum of must be zero.

9. 9. r 7a. I a. Choose the correct answers for the following : i) The unit of radius of Gyration-is A) mm B) mm2 C) mm3 Choose the correct answers for the following : i) Angle of friction is angle between A) the incline and horizontal B) the normal reaction and friction force C) the weight ofthe body and the friction force D) Normal reaction and the resultant. ii) The force offriction developed at the contact surface is always A) Parallel to the plane and along the direction ofthe applied force B) Perpendicular to the plane C) Parallel to the plane and opposite to the direction ofthe motion 10cIv13/2s (04 Marks) D) All of these. ii| The maximum inclination of the plane on which the body free from external forces can repose is called A) Cone of friction B) Angle of friction C) Angle of repose D) None ofthese irr) The force offriction depends on A) Arya of contact B) Roughness ofthe surface C) Both area ofcontact and roughness ofthe surface D) None ofthese. State the laws of static friction.b. c. (04 Ma rks) A uniform ladder of length 15m and weight 750N rests against a vertical wall making an angle of 60o with the horizontal. Co-efficient of fiiction between the wall and the ladder is 0.3 and between the ground and the ladder is 0.25. A man weighing 500N ascends the ladder. How long will he be able to go before the ladder slips? (12 Marks) (04 Marks) D) mmn i0 The moment of inertia ofan area about an axis which is in a plane perpendicular to the area is called A) Radius of Gyration C) Second moment of area iii) The moment of inertia of a circle with'd' as its diameter about its centroidal axis B) Polar moment of inertia D) None of these b. c. A ItD'/^ ' ,/)z u, "o/* ct "D',/sz, o, "ozo iv) Ths.moment of inertia ofa square ofside 'b' about an axis through its centroid is ^ %, B) b% ct bZa ot %z State and prove parallel axis theorem. Find the moment of inertia of the region shown in Fig. also find the radius of Gyration about the same axis. klL Di nt c t4*'o hE q rc N WITV Fig. Q8 (c) 4of4 (06 Marks) QB (c) about horizontal axis AB and (10 Marks) B

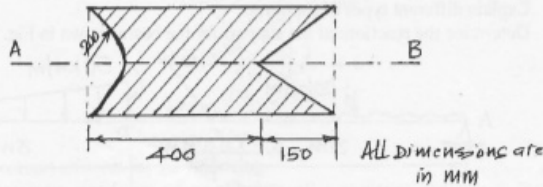10. 10. v tf I m €, o o 3 (I b. d. E ',. =_. ool EO P= i 50i Jo, 5! ;. ,._ ^-odbo E= Ei o<. ^i ; z aq tr USN t0BinllEt4l24 First/Second Semester B.E. Degree Examination, June/Juty 2013 Elements of Mechanical Engineering Time: 3 hrs. Max. Marks: 100 Note: l. Answer any FIW full questions, choosing at least two from each part. 2. Answer all objective type questions only on OMR sheet poge 5 of the onswer booklet 3. Answer to objective 4tpe questions on sheets other than OMR will not be valued. PART _ A I a. Choose the correct answers for the following : i) Lunar is _ form ofenergy A) Stored C) Celestial iD Enthalpy is also called as A) Low C) Medium iu) Feed check valve is a boiler mounting for A) Safety C) Testing 2 a. Choose the correct answers for the following : i) An example for a reaction turbine is A) Laval turbine C) Zoelly turbine ii) The weight to power ratio of a gas turbine is A) High C) Moderate iii) Draft tube is a A) Sufficient heat B) Insufficient heat C) Total heat D) Incomplete heat Steam pressure is in water tube boilers B) Transit ional D)Capital B) High D) Absolute (04 Marks) (06 Marks) (04 Marks) (06 Marks) (04 Marks) (06 Marks) (04 Marks) (06 Marks) - B) Operation D) Security Compare and contrast renewable and non renewable erielily sources. Enumerate the advantages and disadvantages of superheated-steam. Explain briefly air pieheater, superheater and Chimney with respect to boilers. A) Closed C) Converging iu) Kaplan turbine is a A) High C) Medium steel pipe head turbine B) Curtis turbine D) Parson's turbine B) Less D) Equal B) Open D) Diverging B) Low D) Simple b. c. d. With a neat sketch, explain the working principle of an impulse turbine. List any four differences between closed cycle and open cycle gas turbines. Define

radial flow, axial flow and mixed flow with respect to water turbine. I of4

11. 11. I 3 a. Choose the correct answers for the following : , Flywheel is used as an energy _ A) Receiver C) Mixer b. Mention the uses of any four reliigerants. iD Mechanical effrciency ofa four-stroke engine is A) Medium C) Low iif.',,, The output shaft in IC engines is A) Camshaft C) Rotary shaft iv) In C.I..engines, charge means A) Air and tuel C) Air and water A) Low C) Moderate B) Reservoir D) Multiplier B) High D) Balanced B) Crankshaft D) Arial shaft B) Only tuel D) Only air b. List any four differences between two-stroke and four-stroke engines. (04 Marks) c. A six cylinder 4-stroke I.C. engine develops 50 kW of indicated power at mep of700 kPa. The bore and stroke lenglh are.70mm and 100mm respectively. If the engine.speed is 3700 rpm, find the average misfires per unit time. 1{i6 Marks) B) Effluent D) Refrigerant B) Ten D) Hundred B) Temperature D) Efficiency B) High D) Unity d. Draw a schematic diagram ofLC. engirxti;nd name the parts. 4 a. Choose the corect answers for the following : i) Brine is an example for A) Coolant C) Deodouraitt ii) The value ofCOP is greater than A) Infinity C)lnity iii)... A thermostat in A.C. is used to control '. ..'-.,. A) Pressure .. " C) Volume iv) The viscosity ofan ideal refrigerant should be (04 Marks) c. With a neat sketch, explain the working of a vapour absorption refrigerator. (06 Marks) d. List the differences between vapour compression refrigeration and vapour absorption t0EIs[Et4l24 (04 Marks) (06 Marks) (04 Marks) refrigeration. 2 of4 (06 Marks)

12. 12. 5a. t0Blrtlrt4t24 PART-B Choose the coffect answers for the following : (04 Marfuq) i) Compound side swiveling method is used to produce .., .1.i,," A) Hole B) Tlreads .. I, C) Knurl D) Taper ii) Lathe Dog is A) A part B) A component i;..'..'C) An accessory D) An assembly r i iii) . ., is an operation to produce a conical surface at the end ofapredrilled hole A) Counter Boring B) Counter sinkiilg. -, C)'Tapping D) Reaming--...,1 ' iv) The sripporting section (core) ofa drill is called A) Web B) Tang, C) Land D) {qi€in With a neat sketch, explain. the principle and operdft'lrfr to produce a 'taper' on lathe by tail stock set over method' ,,1 ,r, .' (06 Marks) Differentiate between cross slidti and.comiiriifrd slide. (04 Marks) With a neat sketctr, explain the ope;$pyi'ff a radial drilling machine. (06 Marks) .: 1:r- Choose the correct answ,gr'g for the following : 1'i (04 Marks) i) Conventional miUing is also called A) End milling lr B) illimhmilling C) Peripheral milling D) Up milting ii) The millitrgiprocess used to produce V - blocks is calloel"i ""- A) For.rn milling B) Slot milling C)"Angular milling D) Slab milling'.'.'.: iii) Flint is an example for a abrasive A) Artificial B) Natural i..:- -, I C) Strong D) Weak iv) The bond used for manufacturing elastic grinding wheels is called ,. , . A) Shellac B) Vitrified C) Resinoid D) Oxy - chlorid" , .. , b. 6a. c. d. (06 Mar*r)- _ b. Differentiate between up milling and down milling. c. List any four differences between horizontal milling machine and vertical milljng d. With a neat sketch, explain the principle of centreless cylindrical grind 3of4

13. 13. :]lE .T toEi$trEt4t24 (04 Marks) ., i) Spelter is used ir1 Ay," A) Welding '(Ot c) Soldering '-/)l ii) - is usedii) - is used as flux in welding, - i e;- sodirm phosphat" B) Sodium cmbonate ,*' e," Ci SoAium riticate D) Sodium chloride u* 7 a. Choose correct answers for the following : -^-v Jperlel rS useu r& !: al W"fairg B) Brazing -$it'C) Soldering D)Electroplating ,- - ?- is used as flux in welding, ,); I}rl gJ gooo luDrlcanl snuuru us' aL 'Q4Higltly volatrle B) Non-volatile ,-,.al ffi-ess volatile D) Moderately -vd{tilt iv) Ctlile*ing is an example for, r,-1 A) Rtdd$aring B) Joumal.b{af,ing cl rnnE6ryie D) slee{}btoinc b. With a neat sketch Y{}in a foot step bearing - 9' (06 Mrks) s. Explainsplasht'bb;{dh4"**ruo*l .^ & (06Marks) ,:..:""::::::::m"-' :,.:"- A) Repairable , n/ t-l-P) Not repairable Ci Quicklyrepairubf"$- @asilyrepairable iD Belts transmit monpftty ' *iFi'"* -.$'"r----- r *fu: h C) Sodium silicate Y42r.$ good lubricant should be, '.TAlHishly volatile B) Sodium cmbonate *'* D) Sodium chloride {{) B) Non-volatile -- * B) Fraction 'r?D) Integration * $. C) Suction ^(;v D) Exq{Pp iii) irr" .*iA&-tn" tootl below the pitch chcle i. ""t.HA--............_, {)ltpi;il6e Pllruok *?^ C) Suction ^(3- D) iv) fi$ffiJ"",.sthe_orthepitch D)Face -'QO, - frl-. D n-^^4:^- / t , {.. j F.Differentiate between an open belt drive and cross belt drive. "- {o4 Marks) J ;..1 c. Enumerate the advantages and disadvantages of gear drives. to'r'1fi&t")*^t} l C. Dnumefale tng a0vanlages aIru UrSauYanIlaBrD ur Bsill uIIvEs. (vu4qtr ns, .r. - S-9 d. A V-belr drive transmits l0 kW power at 240 rpm. The grooved pulley has a mean dt #ry; of 1.2 m and groove angle of45o. Taking p:0.3 and angle of lap equal to n radians,' determine the tensiens on each side ofthe belt. 4 of4 ' (06 Marks)

14. 14. USN 10ELE15/2s D) Kirchhoffs law (05 Marks) iii) the equivalent (06 Marks) c. d. o. E ! 2 fs = v') --t drq u= boc .].o) 5! a,i ;- q- ooo o= =q c) o< -; ci o z o o. First/Second Semester B.E. Degree Examination, June/July 2013 Basic Electrical Engineering Time: 3 hrs. Max. Marks:llOb Note: 1. Answer ony FIVE full questions, choosing at least two from each port. 2. Answer oll objective type questions only on OMR sheet page 5 of the answer booklet. 3. Answer to objective type questions on sheets other than OMR will not be valued. (04 Marks) PART-A I a. Choose the correct answers for the following : i) The condition for the validity under Ohm's law is that the A) temperature should remain constant B) cunent should be proportional to voltage C) resistance must be wire wound type D) all of the above. ii) A linear resister is one v(,hich obey's A) Ampere's law B.1 Lenz's law C) ohms law b. iv) Resistance of a wire always increases if A) temperature is reduced B) temperature is increased C) number of free electrons available become less D; number of free electrons available become more. Find the resistance ofthe circuit shown (Rap). Fie.Ql(b) 2.5amperes. Find i) cunent in other resistors ii) resistor X resistance. Refer fig. Ql(d). !rr- iii) The resistance ofa conductor having length 0, area ofcross section a and resistivity p is given as A) R=+ B) R=Pl c) R:pta o) R= I laap State and explain Kirchoff s laws. (0!I{arks) In the parallel arrangement ofresistors shown the current flowing in the 8f) resistor is /,f" -,' Fig.Ql(d) I of4

15. 15. a. Choose the comect answers for the following : i) The law that hnds application in electrolysis 10ELEt5/25 (04 Marks) A) Faraday's law B) Coulomb's law C) Ohm's law D) Lenz's law ii) According to Faraday's law of electro magnetic induction an emf is induced in a conductor whenever it A) lies in a magnetic field B) lies perpendicular to the magnetic field C) cuts the magnetic flux D) moves parallel to the direction of magnetic field. iii) "ln all cases of electromagnetic induction, an induced voltage will cause a current to ' flow in a closed circuit in such a direction that the magnetic field which is caused by that current will oppose the change that produces the current" is the original statffnent of A) Lenz's law C) Fleming's law of induction B) rms value to average value D) peak value to rms value B) D) Faraday's law of magnetic induction Ampere's law iv) Which law is synonymous to the occurrence of diamagnetism A) Ampere's law B) Maxwell's law C) Coulomb's law D) Lenz's law. b. State and explain Faraday's laws of eleclromagnetic induction. (08 Marks) c. Derive the expression for energy stored in an inductor. (08 Marks) a. Choose the correct answers for the following : (0,1 Marks) i) The form factor is the ratio of A) average value to rms value C) peak value to average value ii) In an R L series circuit the pf is A) leading B) lagging C) zero iii) The power factor ofan ac circuit is equal to D) unity A) cosine ofthe angle C) unity for a resistive circuit B) sine ofthe phase angle D) unity for a reactive circuit b. iv) In a pure capacitive circuit, the current will A) lag behind the voltage by 900 B) lead the voltage by 900 C) remain !n phase with voltage D) None of these Derive an expreSsion for the impedance of an ac circuit con5isting of a resistance an inductance and a capacitance connected in series. (10 Marks) 125 volts at 60Hz is applied across a capacitance connected in series with a non inductive resistor. The combination canies a current of 22A and causes a power loss of 96.8 w in the resistor. Power loss in the capacitor is negligible. Calculate the resistance and capacitance. (06 Marks) a- Choose the correct answers for the following : i) In a 3 phase balanced star coruleted load, neutral current is equal to A) Zero B) I' C) IL D) Unpredictable ii) The relationship between the line and phase voltage ofa delta connected circuit is given by A) Vl: Vp B)vL: JJ vp c) Vr: V.: ?V, 1l iii) The power in a 3 phase system is given by 1/3 V; 11- cos Q, where $ is the phase angle between A) line voltage and line current C) line voltage and phase current B) phase voltage and phase current D) phase voltage and line current 2of4 (04 Marks) 6 D)

16. 16. 10ELE15/25 iv) Three equal impedances are t-rst connected in delta across a 3 - phase balanced supply. Ilthe same impedances are connected in star across the same supply A) phase currents will be one - third B) line currents will be one - third C) power consumed will be one - third D) None of these b. Derive the relationship between a line current and a phase cunent and a line voltage and c. d. phase voltage related to a star connected load. Mention different types of wiring used in domestic dwellings. PART - B Choose the correct answers for the lbllowing : i) The emf generated in a dc generator depends upon B) commutation D) terminal voltage (07 Marks) (03 Marks) (04 Marks) (04 Marks) Explain construction and working principle ofinduction tlpe single phase energy meter. (06 Marks) ii) The dc generator having residual magnetism gives zero induced em{ the speed will be A) zero B) very small C) rated one A) brush contact drop C) number ofparallel paths iii) The field coils of a dc machine are made of A) carbon B) copper C) mica to step down the voltage D) any D) steel D) statorB) held C) armature b. The emf generated in the armature of a shunt generator is 625 volts, when delivering its full load current of400 A to the external circuit. The field current is 6 amp and the armature resistance is 0.060. What is the terminal voltage? (08 Marks) c. A 220 volts series motor is taking a curent ol40 amperes. Resistance of armature 0.5O, resistance of series field is 0.25ohm.

Calculate i) Voltage at the brushes ii) Back emf iii) Power wasted in armature iv) Power wasted in series field. (08 Marks) iv) The rotating part of a dc machine is called the A) rotor Choose the correct answers for the following : i) Transformer is used A) to step up the voltage B) C) on dc ii) A transformer does not transfrom D) to step up or step down the voltage A) power B) voltage C) cument D) impedance iii) In a transformer, electrical power is transl'erred lrom primary to secondary A) through air C) through insulating medium iv) The two windings of a transformer are B; by magnetic flux D) none olthese B) inductivelv linked D1 electrica lly linked ::i A) conductively linked C) not linked at all b. Explain principle of operation of a equation. single phase transformer and A single phase. 20 KVA transformer has 1000 primary turns and 2500 secondary tums. The net cross sectional area of the core is l00cm2. When the primary winding is connected to 500V , 50Hz supply, calculate i) the maximum value ofthe flux density in the core ii) the voltage induced in the secondary winding and iii) the primary and secondary fuIl load currents. (08 Marks) 3 of4

17. 17. 1oELE15/25 7 a. Choose corect answers for the following : (04 Marks) i) In a synchronous machine, the stator frame is made of, A) Stain steel B) CRCoGS C) Cast iron or welded steel plates D) Laminated silicon steel ii) The stator core of a synckonous machine is laminated so as to reduce, A) Eddy current loss '.-"' B) Hysteresis C) Both eddy current and hysteresis loss D) The size and weight of the machine 'iii) The stator slot insulations in synchronous made o{ A) Mica cloth B) Fibre glass C) Polister sheets D) Any of these iv) The machine that supplies dc to the rotor is called the, A) Recti.iier B) Exciter C) Convertor D) Invertor b. Derive EMF equation of an altemator. (08 Marks) c. Explain construction and working principle ofsynchronous generator. (08 Marks) 8 a. Choose the correct answers for the following : (04 Marks) i) Ifa single phase induction motor runs at a speed lower than the rated one, the most likely defect is, A) improper size fuses B) Worn-out bearings or low voltage or over load C) Open-circuit in the winding D) Shon-circuit in the winding ii) If the starting winding of a single phase induction motor is left in the circuit, A) the motor will run faster B) the motor will run slower C) there will be undue sparking D) the auxillary winding will get over-heated due to continuous flow of current and may get damaged. iii) Which of the following types of motors are not single phase ac motors? A) Induction type'motors B) Commutalor type motors C) Synchronoris type motors D) Schrage motors iv) Which of the following types of motors are not the induction motors? A) Repulsion motors B) Split phase motors C). Stiaded pole motors D) Repulsion start induction motors b. Explain construction and working principle of star-delta stafier. (08 Marks) c. What is meant by the slip of the induction motor? Under what circumstances the slip is i) unity and ii) zero. (08 Marks) 4of4
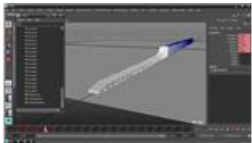
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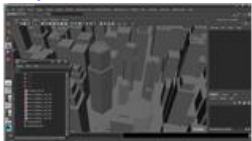
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