USN ☐☐☐☐☐☐☐☐☐☐   **14MAT11**

First Semester B.E. Degree Examination, Dec.2016/Jan.2017
Engineering Mathematics – I

Time: 3 hrs.   Max. Marks:100

Note: *Answer FIVE full questions, selecting ONE full question from each module.*

Module – 1

1   a.   Find the nth derivative of $\dfrac{x}{(x-1)(x^2+x-2)}$.   **(07 Marks)**

    b.   Find the angle of interaction of the curves, $r = a(1+\cos\theta)$ and $r^2 = a^2\cos 2\theta$.   **(06 Marks)**

    c.   Derive an expression for the radius of curvature in polar form.   **(07 Marks)**

<div align="center">OR</div>

2   a.   If $\sin^{-1} y = 2\log(x+1)$, prove that $(x+1)^2 y_{n+2} + (2n+1)(x+1)y_{n+1} + (n^2+4)y_n = 0$.
      (07 Marks)

    b.   Find the pedal equation, $r^m = a^m(\cos m\theta + \sin m\theta)$.   **(06 Marks)**

    c.   If ρ be the radius of curvature at any point P(x, y) on the parabola $y^2 = 4ax$ show that ρ^2 varies as $(SP)^3$ where S is the focus of the parabola.   **(07 Marks)**

Module – 2

3   a.   Obtain Taylor's series expansion of $\log(\cos x)$ about the point $x = \dfrac{\pi}{3}$ upto the fourth degree term.   **(07 Marks)**

    b.   If $u = f(r)$ where $r = \sqrt{x^2+y^2+z^2}$, show that $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} + \dfrac{\partial^2 u}{\partial z^2} = f''(r) + \dfrac{2}{r}f'(r)$.   **(06 Marks)**

    c.   If $u = f\left(\dfrac{x}{y}, \dfrac{y}{z}, \dfrac{z}{x}\right)$, prove that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} + z\dfrac{\partial u}{\partial z} = 0$.   **(07 Marks)**

<div align="center">OR</div>

4   a.   Evaluate $\lim\limits_{x\to 0}\left[\dfrac{1}{x^2} - \cot^2 x\right]$.   **(07 Marks)**

    b.   If u be a homogeneous function of degree n in x and y, prove that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = nu$.   **(06 Marks)**

    c.   If $u = x^2+y^2+z^2$, $v = xy+yz+zx$, $w = x+y+z$ find $\dfrac{\partial(u,v,w)}{\partial(x,y,z)}$.   **(07 Marks)**

Module – 3

5   a.   Find the unit tangent vector and unit normal vector to the curve $\vec{r} = \cos 2t\, i + \sin 2t\, j + tk$ at $x = \dfrac{1}{\sqrt{2}}$.   **(07 Marks)**

    b.   Using differentiation under the integral sign, show that $\displaystyle\int_0^\pi \dfrac{\log(1+a\cos x)}{\cos x}\,dx = \pi\sin^{-1}a$.   **(06 Marks)**

    c.   Use general rules to trace the curve $y^2(a-x) = x^3$, $a > 0$ **(07 Marks)**

<div align="center">OR</div>

6 a. Show that $\vec{F} = \dfrac{x i + y j}{x^2 + y^2}$ is both solenoidal and irrotational. (07 Marks)

   b. Show that $\text{curl}\left(\phi \vec{A}\right) = \phi(\text{curl}\,\vec{A}) + \text{grad}\phi \times \vec{A}$. (06 Marks)

   c. Use general rules to trace the curve, $r = a\cos 2\theta$ (four leaved rose). (07 Marks)

Module – 4

7 a. Obtain the reduction formula for $\int \sin^m x \cos^n x\, dx$, where m and n are positive integers. (07 Marks)

   b. Solve $y(1 + xy + x^2 y^2)dx + x(1 - xy + x^2 y^2)dy = 0$. (06 Marks)

   c. Find the orthogonal trajectories of the family of curves $r = 4a\sec\theta\tan\theta$. (07 Marks)

OR

8 a. Evaluate (i) $\displaystyle\int_0^{2a} x^2 \sqrt{2ax - x^2}\, dx$ (ii) $\displaystyle\int_0^{2a} \dfrac{x^2}{\sqrt{2ax - x^2}}\, dx$. (07 Marks)

   b. Solve $\dfrac{dy}{dx} - y\tan x = \dfrac{\sin x \cos^2 x}{y^2}$ (06 Marks)

   c. The R-L series circuit differential equation acted on by an electromotive force $E\sin\omega t$ satisfies the differential equation, $L\dfrac{di}{dt} + Ri = E\sin\omega t$. If there is no current in the circuit initially, obtain the value of current at any time 't'. (07 Marks)

Module – 5

9 a. Solve $2x + y + 4z = 12$, $4x + 11y - z = 33$, $8x - 3y + 2z = 20$ by Gauss elimination method. (07 Marks)

   b. Diagonalize the matrix, $A = \begin{bmatrix} -19 & 7 \\ -42 & 16 \end{bmatrix}$. (06 Marks)

   c. Determine the largest eigen value and the corresponding eigen vector of $A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$ using Rayleigh's power method. (07 Marks)

OR

10 a. Solve by LU decomposition method, $4x_1 + x_2 + x_3 = 4$, $x_1 + 4x_2 - 2x_3 = 4$, $3x_1 + 2x_2 - 4x_3 = 6$. (07 Marks)

   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 transformation. (06 Marks)

   c. Reduce the quadratic form, $x_1^2 + 5x_2^2 + x_3^2 + 2x_1 x_2 + 6x_1 x_3 + 2x_2 x_3$ into canonical form by orthogonal transformation. Indicate the orthogonal transformation. (07 Marks)

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Second Semester B.E. Degree Examination, Dec.2016/Jan.2017
Engineering Mathematics – II

Time: 3 hrs.   Max. Marks:100

Note: *Answer FIVE full questions, selecting ONE full question from each module.*

Module – 1

1 a. Solve $\dfrac{d^4y}{dx^4}+5\dfrac{d^3y}{dx^3}+6\dfrac{d^2y}{dx^2}-4\dfrac{dy}{dx}-8y=0$. **(06 Marks)**

   b. Solve $\dfrac{d^3y}{dx^3}+2\dfrac{d^2y}{dx^2}+\dfrac{dy}{dx}=e^{-x}+\sin 2x$. **(07 Marks)**

   c. Solve by the method of undetermined coefficient, $\dfrac{d^2y}{dx^2}+2\dfrac{dy}{dx}+4y=2x^2+3e^{-x}$. **(07 Marks)**

2 a. Solve $4\dfrac{d^4y}{dx^4}-8\dfrac{d^3y}{dx^3}-7\dfrac{d^2y}{dx^2}+11\dfrac{dy}{dx}+6y=0$ **(06 Marks)**

   b. Solve $\dfrac{d^2y}{dx^2}+3\dfrac{dy}{dx}+2y=1+3x+x^2$. **(07 Marks)**

   c. Solve by the method of variation of parameter $y''+a^2y=\sec ax$. **(07 Marks)**

Module – 2

3 a. Solve $x^2\dfrac{d^2y}{dx^2}+5x\dfrac{dy}{dx}+13y=\log x+x^2$. **(06 Marks)**

   b. Solve $x^2p^2+3xyp+2y^2=0$. **(07 Marks)**

   c. Find the general and singular solution of, $(x^2-1)p^2-2xyp+y^2-1=0$. **(07 Marks)**

4 a. Solve the system of equations,
       $\dfrac{dx}{dt}=3x-4y, \dfrac{dy}{dt}=x-y$. **(06 Marks)**

   b. Solve $(1+x)^2\dfrac{d^2y}{dx^2}+(1+x)\dfrac{dy}{dx}+y=2\sin\log(1+x)$. **(07 Marks)**

   c. Solve $y=2px-yp^2$ **(07 Marks)**

Module – 3

5 a. Form a partial differential equation by eliminating arbitrary function,
       $f(x+y+z, x^2+y^2+z^2)=0$ **(06 Marks)**

   b. Derive one dimensional wave equation. **(07 Marks)**

   c. Evaluate $\displaystyle\int_0^1\int_0^{\sqrt{1-y^2}}x^3y\,dx\,dy$. **(07 Marks)**

6 a. Form a P.D.E by eliminating arbitrary constants,
       $\dfrac{x^2}{a^2}+\dfrac{y^2}{b^2}+\dfrac{z^2}{c^2}=1$ **(06 Marks)**

   b. Evaluate $\displaystyle\int_0^4\int_0^{2\sqrt z}\int_0^{\sqrt{4z-x^2}}dy\,dx\,dz$. **(07 Marks)**

c. Solve one dimensional heat equation by separation of variables. Given $\dfrac{\partial u}{\partial t} = C^2 \dfrac{\partial^2 u}{\partial x^2}$.

(07 Marks)

Module – 4

7 a. For m > 0, n > 0 show that $\beta(m,n) = \dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$.

(06 Marks)

b. Prove that $\displaystyle\int_0^1 \dfrac{x^2}{\sqrt{1-x^4}}\,dx \cdot \int_0^1 \dfrac{1}{\sqrt{1+x^4}}\,dx = \dfrac{\pi}{4\sqrt{2}}$.

(07 Marks)

c. Prove that cylindrical co-ordinate system is orthogonal.

(07 Marks)

8 a. Find the volume of the sphere, $x^2 + y^2 + z^2 = a^2$ using triple integral.

(06 Marks)

b. For m and n positive prove that,

$$\beta(m,n) = \int_0^1 \dfrac{x^{m-1} + x^{n-1}}{(1+x)^{m+n}}\,dx .$$

(07 Marks)

c. Express the vector $\vec{f} = 2y\hat{i} - z\hat{j} + 3x\hat{k}$ in cylindrical co-ordinates.

(07 Marks)

Module – 5

9 a. Find the Laplace transform of, (i) $e^{3t}t^4$ (ii) $\sin t \sin 2t \sin 3t$

(06 Marks)

b. A periodic function of period $\dfrac{2\pi}{W}$ is defined by,

$$f(t) = \begin{cases} E\sin\omega t & \text{for}\quad 0 \le t \le \dfrac{\pi}{W} \\ 0 & \text{for}\quad \dfrac{\pi}{W} \le t \le \dfrac{2\pi}{W} \end{cases}$$ where E and W are positive constants. Show that

$$L\{f(t)\} = \dfrac{EW}{(s^2 + w^2)\left(1 - e^{\frac{-\pi s}{W}}\right)} .$$

(07 Marks)

c. Find the inverse Laplace transform, $\dfrac{1}{s(s+1)(s+2)}$.

(07 Marks)

10 a. Find $L\left(\dfrac{\cos 2t - \cos 3t}{t}\right)$.

(06 Marks)

b. Express $f(t) = \begin{cases} t^2 & 1 < t \le 2 \\ 4t & t > 2 \end{cases}$

in terms of unit step function and hence find $L[f(t)]$.

(07 Marks)

c. Solve using Laplace transform method,
$y'' + 2y' - 3y = \sin t$, $y(0) = y'(0) = 0$

(07 Marks)

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Time: 3 hrs. 　　　　　　　　　　　　　　　　　　　　　　　Max. Marks: 100

Note: *Answer FIVE full questions, selecting*
ONE full question from each module.

Module-1

1 a. Define ion selective electrode. Explain the principle and construction of glass electrode.
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(05 Marks)
　 b. Describe the construction and working of Ni-metal hydride battery. Write its application.
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(05 Marks)
　 c. Define concentration cell. The spontaneous cell $Sn|Sn^{2+}$ (0.024 M)$||Sn^{2+}$(0.064)$|Sn$ at 25˚C.
　　Calculate the emf of the cell and cell reactions. 　　　　　　　　　**(05 Marks)**
　 d. Explain the following battery characteristics:
　　　i) Voltage,
　　　ii) Energy efficiency,
　　　iii) Cycle life 　　　　　　　　　　　　　　　　　　　　　　　　**(05 Marks)**

2 a. Derive Nernst's equation for single electrode potential. 　　　　　　**(05 Marks)**
　 b. Define fuel cell. Explain the construction and working of Lithium MnO_2 cell. Write its
　　application. 　　　　　　　　　　　　　　　　　　　　　　　　　　**(05 Marks)**
　 c. What are secondary reference electrodes? Explain the construction and working of Calomel
　　Electrode. 　　　　　　　　　　　　　　　　　　　　　　　　　　　**(05 Marks)**
　 d. Explain the construction and working of Methanol Oxygen fuel cell. 　　**(05 Marks)**

Module-2

3 a. Explain the following corrosion types:
　　　i) Differential metal corrosion,
　　　ii) Differential aeration corrosion. 　　　　　　　　　　　　　　　**(05 Marks)**
　 b. Define electroplating. Write technological importance of metal finishing. 　**(05 Marks)**
　 c. What is anodic metal coating? Explain the process of Galvanizing. 　　**(05 Marks)**
　 d. Describe the electroplating of chromium. 　　　　　　　　　　　　　**(05 Marks)**

4 a. Explain the electrochemical theory of rusting of iron. 　　　　　　　　**(05 Marks)**
　 b. Discuss the electroless plating of copper with reactions. 　　　　　　　**(05 Marks)**
　 c. Explain the factors affecting the rate of corrosion:
　　　i) Nature of corrosion product
　　　ii) pH 　　　　　　　　　　　　　　　　　　　　　　　　　　　　**(05 Marks)**
　 d. Discuss the following principles of metal finishing:
　　　i) Decomposition potential
　　　ii) Over voltage. 　　　　　　　　　　　　　　　　　　　　　　　**(05 Marks)**

Module-3

5 a. Define calorific value of a fuel. Explain the calorific value of solid fuel by determination by
　　bomb calorimeter. 　　　　　　　　　　　　　　　　　　　　　　　**(05 Marks)**
　 b. Define photovoltaic cell. Explain construction and working of PV cell. 　**(05 Marks)**
　 c. Explain the synthesis of petrol by Fischer-Tropsch process. 　　　　　**(05 Marks)**
　 d. Explain the purification of Silicon by zone refining process. 　　　　　**(05 Marks)**

6   a. Define cracking. Explain the process of fluidized bed catalytic process cracking with neat diagram.   (05 Marks)
    b. Discuss the production of solar grade Silicon by Union Carbide process.   (05 Marks)
    c. Write a short note on power alcohol and knocking in petrol engine.   (05 Marks)
    d. Define doping. Write two physical and two chemical properties of silicon.   (05 Marks)

Module-4

7   a. Define polymer. Explain the addition and condensations polymerization with examples.
                                                                                    (05 Marks)
    b. Discuss the synthesis and application of Silicon rubber and polyurethane.   (05 Marks)
    c. Explain any two structures and property of relations of polymers.   (05 Marks)
    d. Write the mechanism of conduction in polyaniline.   (05 Marks)

8   a. Explain free radical mechanism of addition polymerization by taking Vinyl Chloride as an example.   (05 Marks)
    b. Explain the synthesis and applications of (i) plexi-glass, (ii) Teflon.   (05 Marks)
    c. Discuss the factors influencing the T_g:
        i) Flexibility
        ii) Branching and cross linking.   (05 Marks)
    d. What are conducting polymers? Write synthesis properties of Carbon fibres. (05 Marks)

Module-5

9   a. How scales and sludges are formed in boilers and write its disadvantages. (05 Marks)
    b. What are nanoscale materials? Explain synthesis of nanomaterials by chemical vapour condensation method.   (05 Marks)
    c. What is desalination of water? Explain the desalination of sea water by reverse osmosis.
                                                                                    (05 Marks)
    d. Write a note on size dependent properties of nanomaterials.   (05 Marks)

10 a. Write a note on secondary sewage treatment method.   (05 Marks)
    b. Write an account on carbon nanotubes.   (05 Marks)
    c. Define fullerenes. Explain hydrothermal synthesis of nanomaterials.   (05 Marks)
    d. 25 cm^3 of an effluent sample requires for oxidation of 8 cm^3 of 0.001M $K_2Cr_2O_7$. Calculate the COD of the effluent sample.   (05 Marks)

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First/Second Semester B.E. Degree Examination, Dec.2016/Jan.2017
Engineering Physics

Time: 3 hrs.   Max. Marks: 100

Note: 1. *Answer any FIVE full questions, choosing one full question from each module.*
     2. *Physical constants : Velocity of light $C = 3 \times 10^8$ m/s ;*
        Plank's consant $h = 6.625 \times 10^{-34} JS$; Mass of electron $e = 9.11 \times 10^{-31}$ kg ;
        Boltzman constant $K = 1.38 \times 10^{-23}$ JK ; Avagadro number $N_A = 6.02 \times 10^{26}$/ k mole.

Module-1

1 a. Show that how Plank's law can be reduced to Wein's law and Rayleigh – Jeans law.
                                                                          (06 Marks)
   b. What is a Wave function? List the properties of wave function.   **(06 Marks)**
   c. Show that group velocity is equal to particle velocity.   **(04 Marks)**
   d. A Quantum particle is confined to one dimensional box of width 'a' is its first excited state.
       What is the probability of finding the particle over an interval of a/2 marked symmetrically
       at the centre of the box.   **(04 Marks)**

2 a. Explain Black body radiation spectrum.   **(04 Marks)**
   b. Obtain the energy eigen value expression and energy eigen functions for an electron in one
       dimensional potential well of infinite height.   **(08 Marks)**
   c. What are the characteristics of matter waves?   **(04 Marks)**
   d. The velocity of an electron of a hydrogen atom in the ground state is 2.19×10^6 m/s.
       Calculate the wavelength of the de Broglie waves associated with its motion. **(04 Marks)**

Module-2

3 a. Define the terms drift velocity, thermal velocity, mean collision time and mean free path.
                                                                          (04 Marks)
   b. What is Hall effect? Obtain an expression for Hall coefficient.   **(06 Marks)**
   c. Explain the temperature dependence of electrical resistivity in metals and super conductors.
                                                                          (06 Marks)
   d. The Hall coefficient of a specimen of doped silicon found to be 3.66×10^{-4} m^3/Coulomb. The
       resistivity of a specimen is 9.33×10^{-3} ohm – m. Find the mobility and density of the charge
       carrier, assuming single carrier concentration.   **(04 Marks)**

4 a. Explain the success of Quantum free electron theory.   **(06 Marks)**
   b. What are intrinsic and extrinsic semiconductors? Obtain an expression for fermi level in
       intrinsic semiconductors.   **(06 Marks)**
   c. Explain in brief construction and working of maglev vehicles.   **(04 Marks)**
   d. An intrinsic semiconductors has an energy gap of 0.4ev. Calculate the probability of
       occupation of the lowest energy level in conduction band at 100^0C. **(04 Marks)**

Module-3

5 a. Obtain an expression for energy density of emitted radiation under equilibrium condition.
                                                                          (06 Marks)
   b. Obtain an expression for numerical aperture in an optical fiber.   **(05 Marks)**
   c. Explain the construction and working of semiconductor laser.   **(05 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)**

6   a. What is Holography? Explain the recording and reconstruction processes in holography, with the help of suitable diagrams.   (06 Marks)
    b. Describe the application of optical fibers in point to point communication with suitable block diagram.   (05 Marks)
    c. Explain different types of optical fibers.   (05 Marks)
    d. The average output power of Laser Source emitting a laser beam of wavelength 6328 $\overset{0}{A}$ is 5mw. Find the number of Photons emitted per second by the laser source.   (04 Marks)

Module-4

7   a. Explain in brief Seven Crystal Systems, with neat diagram.   (07 Marks)
    b. Define Lattice, basis, crystal structure and unit cell.   (04 Marks)
    c. Explain the procedure to find Miller indices of crystal plane.   (04 Marks)
    d. The first order Bragg's reflection occurs at angle 20^0 in the plane (111). Find the wavelength of X – rays if lattice constant is 3.615 $\overset{0}{A}$.   (05 Marks)

8   a. Derive Bragg's law for crystal structure.   (05 Marks)
    b. Explain the structure of Perovskite crystal structure, with neat diagram.   (07 Marks)
    c. List the differences between LED and LCD devices.   (04 Marks)
    d. Draw the following planes in a cubic unit cell (100) ,(110) , (111) and (112).   (04 Marks)

Module-5

9   a. Explain the description and working of Reddy's shock tube.   (08 Marks)
    b. Describe the various Quantum structures.   (04 Marks)
    c. List the characteristics of Reddy's Shock tube.   (04 Marks)
    d. Describe the preparation of nanoparticles by ball milling method.   (04 Marks)

10 a. Describe Acoustic, Ultrasonic, Subsonic and Supersonic waves.   (04 Marks)
    b. Explain the structure of different Carbon nanotubes, with neat diagram.   (08 Marks)
    c. Describe the principle and working of SEM, with neat diagram.   (08 Marks)

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First/Second Semester B.E. Degree Examination, Dec.2016/Jan.2017
Programming in 'C' and Data Structures

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions, selecting*
ONE full question from each module.

Module-1

1 a. List all the restrictions on the variable names.   (06 Marks)
   b. Explain the block structure of a 'C' program.   (08 Marks)
   c. What are the basic data types available in 'C'? Write the significance of each data type.
                                                                                  (06 Marks)

2 a. What is an assignment statement? Give the general form of an assignment statement.
                                                                                  (05 Marks)
   b. Explain with example, the various constants available in 'C' program.   (05 Marks)
   c. List and explain any five operators used in 'C' programming language.   (10 Marks)

Module-2

3 a. Explain with example, the meaning of statement and block in a 'C' program. (05 Marks)
   b. Explain with a syntax, the different loops used in 'C' program.   (09 Marks)
   c. Write a program in 'C' to find the sum of 'n' natural number without using any loops.
                                                                                  (06 Marks)

4 a. Explain with example, the need of 'break' statement in a 'C' program.   (05 Marks)
   b. Write a 'C' program to demonstrate the use of unconditional goto statement. (06 Marks)
   c. Explain with syntax, if, if-else and nested if-else statements in 'C' program. (09 Marks)

Module-3

5 a. What is the purpose of an array? Explain how two dimensional arrays is declared and
       initialized.   (06 Marks)
   b. Explain with example :
       i) Character string
       ii) String literal.   (06 Marks)
   c. Write a program in 'C' using functions to swap two numbers.   (08 Marks)

6 a. Explain with syntax and example, the different types of string manipulation functions.
                                                                                  (10 Marks)
   b. Explain with example, the general form of puts and gets function.   (04 Marks)
   c. What are the three possibilities of defining a user defined functions in 'C'? (06 Marks)

Module-4

7 a. What is a structure data type? Give the general form of a structure declaration. (05 Marks)
   b. Explain the syntax of fprintf and fscanf functions in 'C'.   (05 Marks)
   c. Using the structure data type, write a program in 'C' to read a student record from the
       keyboard and store it in a file called student·dot.   (10 Marks)

8 a. Explain the differences between arrays and structures. (05 Marks)
   b. What is a file? Explain fopen( ) and fclose( ) functions in 'C' language. (06 Marks)
   c. Write a program in 'C' using structure to read USN, name and marks in 3 subjects for each student and store it in a file called studmarks·dat. (09 Marks)

Module-5

9 a. Write a 'C' program to define macros for logical operators. (08 Marks)
   b. Explain the following :
       i) preprocessor directive
       ii) malloc( ) function
       iii) # include directive. (06 Marks)
   c. Explain the need of dynamic memory allocation. (06 Marks)

10 a. Explain with example # define directive. (04 Marks)
   b. What is a stack? What are the operations we can carry out on a stack? (08 Marks)
   c. Write a program in 'C' to create a simple linked list. (08 Marks)

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First/Second Semester B.E. Degree Examination, Dec.2016/Jan.2017
Elements of Civil Engineering and Mechanics

Time: 3 hrs.   Max. Marks:100

Note: *Answer FIVE full questions, selecting*
ONE full question from each module.

Module – 1

1 a. With a neat sketch, explain the components of i) Earth dam; ii) Gravity dam.   **(10 Marks)**
   b. Determine the X and Y components of the forces shown in Fig.Q.1(b).   **(10 Marks)**
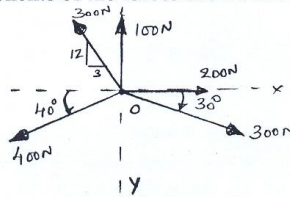
Fig.Q.1(b)

2 a. Define couple and state its characteristics.   **(06 Marks)**
   b. Draw a neat sketch of RCC-T beam bridge and name its components.   **(04 Marks)**
   c. Replace the system of forces acting on the frame shown in Fig.Q.2(c), by a resultant force 'R' through 'A' and a couple acting horizontally through 'B' and 'C'.   **(10 Marks)**
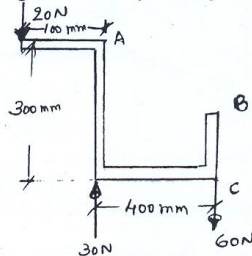
Fig.Q.2(c)

Module – 2

3 a. State and prove parallelogram law of forces.   **(06 Marks)**
   b. Check the stability of the dam carrying the forces as shown in Fig.Q.3(b). The dam is said to be stable if the resultant lies in the middle 1/3 of the base OT.   **(10 Marks)**
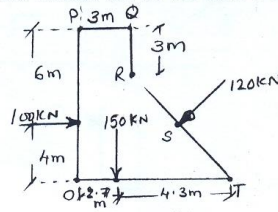
Fig.Q.3(b)

   c. Define resultant and equilibrant of a force system.   **(04 Marks)**

1 of 4

4   a. State and prove Varignon's theorem.   **(06 Marks)**
    b. Two locomotives on opposite banks of a canal pull a vessel moving parallel to the banks of a
        canal by means of ropes as shown in Fig.Q.4(b). The tension in the ropes are 20kN and
        24kN while the angle between them is 60°. Find the resultant pull on the vessel along the
        centerline and the angle 'α' and 'β'.   **(08 Marks)**
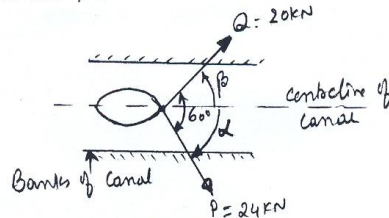
Fig.Q.4(b)

    c. An electric transmission tower supports two cables carrying tensions of 80kN and 120kN as
        shown in Fig.Q.4(c). Determine the required tension in the guy wire AB, so that the resultant
        of the forces exerted by three cables will be vertical. Also find the magnitude of the
        resultant.   **(06 Marks)**
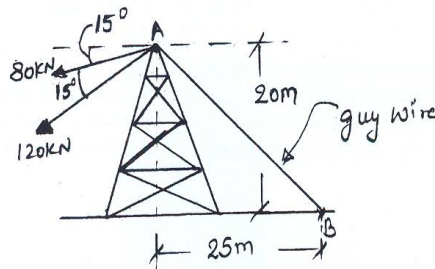
Fig.Q.4(c)

Module – 3

5   a. State conditions of equilibrium for coplanar concurrent and non concurrent force system.
                                                                               (04 Marks)
    b. Draw a neat sketch showing the number of reactions at   i) Roller support;   ii) Hinged
        support;   iii) Fixed support.   **(06 Marks)**
    c. Find the least value of 'P' required to cause the system of block shown in Fig.Q.5(c) to have
        impending motion to the left. The coefficient of friction for all contact surfaces are 0.2.
                                                                               (10 Marks)
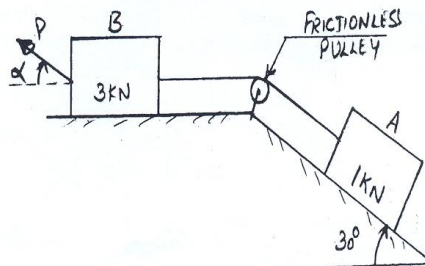
Fig.Q.5(c)

6 a. Define the terms: i) Coefficient of friction; ii) Angle of repose.   (06 Marks)
   b. Find the reactions for the beam loaded as shown in Fig.Q.6(b).   (06 Marks)
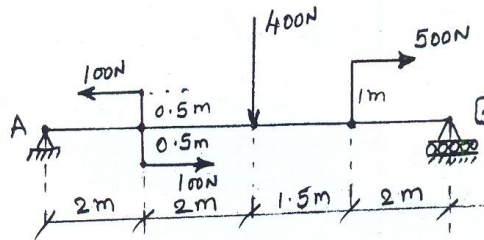
Fig.Q.6(b)

   c. Cylinder 'A' of diameter 200mm and cylinder 'B' of diameter 300mm are placed in a trough
       shown in Fig.6(c). If cylinder 'A' weighs 800N and cylinder 'B' weighs 1200N, determine
       the reactions developed at contact surfaces P, Q, R and S. Assume that all contact surfaces
       are smooth.   (08 Marks)
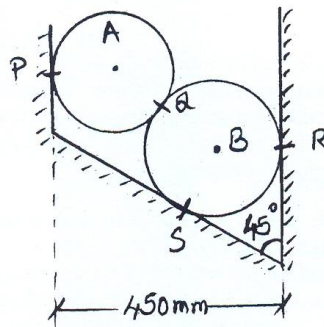
Fig.Q.6(c)

Module – 4

7 a. Derive an expression for the centroid of a semicircle of radius 'r' with respect to the base of
       the semicircle from the first principles.   (06 Marks)
   b. Determine the radius of gyration for the area shown in Fig.Q.7(b), along horizontal XX and
       vertical YY axis passing through the centroid of the area.   (14 Marks)
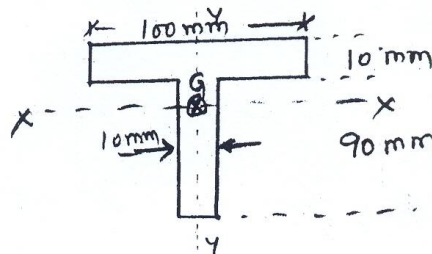
8 a. State and prove parallel axis theorem. (06 Marks)
   b. Locate the centroid of the lamina shown in Fig.Q.8(b) with respect to point 'O'. (14 Marks)
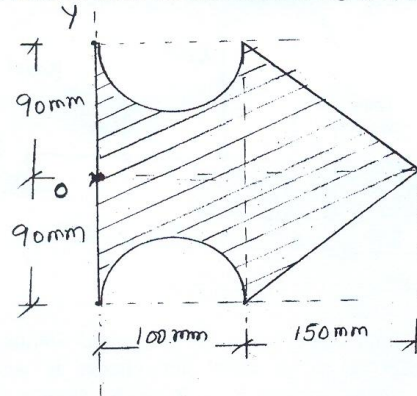
Fig.Q.8(b)

Module – 5

9 a. State Newton's Law's of motion. (06 Marks)
   b. What is super elevation and list the benefits of providing the super elevation. (06 Marks)
   c. A projectile is fired at certain angle with the horizontal and has a horizontal range of 3.5km. If the maximum height reached is 500m, what is the angle of elevation of the cannon? What was the muzzle velocity of the projectile? (08 Marks)

10 a. A small steel ball is shot up vertically with a velocity of 19.6 m/sec, from the top of a building 24.5m high. Calculate:
   i)   Time required for the ball to reach maximum height.
   ii)   How high the ball will rise above the building?
   iii) Compute the velocity with which it will strike the ground.
   iv)   Total time for which the ball is in motion. (10 Marks)
   b. The distance between two stations is 2500m. The locomotive starts from first station with an acceleration such that it reaches a speed of 36 kmph in 30 secs until its speed attained is 55 kmph. This speed is maintained until the brakes are applied and the locomotive is brought to rest at second station with a retardation of 1m/sec². Find the time taken to perform the journey and the distance covered during the acceleration, uniform and retarded motion. (10 Marks)

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First/Second Semester B.E. Degree Examination, Dec.2016/Jan.2017
Basic Electrical Engineering

Time: 3 hrs. Max. Marks: 100

Note: *Answer FIVE full questions, choosing one full question from each module.*

Module-1

1. a. Calculate effective resistance between points A and B for the combination of resistances given in fig.Q1(a). **(05 Marks)**

   Fig.Q1(a)
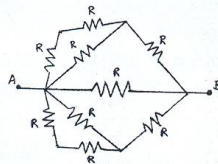
   b. Bring out clearly analogy between Magnetic and Electric circuits. **(06 Marks)**
   c. State and explain : i) Faraday's laws   ii) Fleming's left hand rule   iii)   Fleming's right hand rule. **(09 Marks)**

OR

2. a. The domestic power in a house comprises of loads as given in table. Calculate i)   The total load and current taken from the supply of 230V   ii)   Total energy consumption per month 1HP = 746W. **(08 Marks)**

Sl. No.	Item	Load	Hours used/day
1	8 Lamps	100 W	10
2	3 fans	80 W	8
3	1 Refrigerator	½ HP	24
4	1 Heater	1000 W	1

   b. An air cored Solenoid consists of 1500 turns of wire wound on a length of 60cm. A search coil of 500 turns, enclosing a mean area of $20cm^2$ is placed centrally in the solenoid. Find i) the mutual inductance of the arrangement   ii)   the emf induced in the search coil, when the current in the solenoid is changing uniformly at the rate of 250A/sec. **(06 Marks)**
   c. Derive an expression for dynamically induced e.m.f. **(06 Marks)**

Module-2

3. a. With neat sketch, explain the constructional features of a D.C machine. **(08 Marks)**
   b. Explain with neat sketch, the construction, working and theory of operation of Dynamometer type Wattmeter. **(08 Marks)**
   c. A four pole D.C. motor has its armature lap wound with 1040 conductors and runs at 1000 rpm, when taking an armature current of 50A from a 250V D.C supply. The resistance of the armature is 0.2Ω. Calculate the useful flux per pole of the motor. **(04 Marks)**

OR

4. a. Explain types of D.C. motors and characteristics of D.C. shunt motor. **(08 Marks)**
   b. Derive the e.m.f. equation of a D.C. generator. **(06 Marks)**
   c. List out applications of D.C. motor and explain why starter is required for a D.C. motor. **(06 Marks)**

Module-3

5. a. Define i) Real power   ii) Reactive power   iii) Apparent power   iv) Power factor v)   Form factor. **(05 Marks)**

b. Find the total current, power and power factor of the circuit given in fig. Q5(b). **(07 Marks)**

Fig.Q5(b)
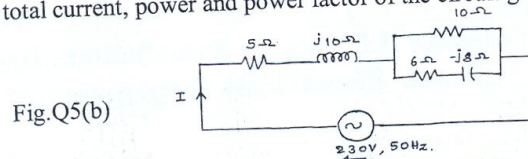
c. Write a note on : i) Two way control of lamp   ii) M.C.B. **(08 Marks)**

OR

6 a. With a neat diagram, explain service mains, meter board and distribution board of a domestic wiring system. **(08 Marks)**

b. Derive an equation for the power consumed by an R-C series circuit. Draw the waveforms of voltage, current and power. **(08 Marks)**

c. An alternating current i is given by $i = 141.4 \sin 314t$. Find   i) The maximum value
   ii) Frequency   iii) Time period and   iv) the instantaneous value when t is 3m.s. **(04 Marks)**

Module-4

7 a. Show that two Wattmeters are sufficient to measure three phase power and also derive expression for power factor. **(08 Marks)**

b. Write the differences between salient pole type and non salient pole type rotor of a synchronous generator. **(04 Marks)**

c. Each phase of a delta connected load comprises a resistor of 50Ω and capacitor of 50 µf in series. Calculate i) line and phase currents   ii) total power when load is connected to a 440V, 3 phase, 50Hz supply. **(08 Marks)**

OR

8 a. A 4 pole, 3 phase, 50Hz star connected alternator has an induced line voltage of 3300V. Determine the flux per pole assuming $K_p = 1$ and $K_d = 0.96$. The armature has 9 slots per pole and 8 conductors per slot. **(06 Marks)**

b. The input power to a 1.6KV, 50Hz, 3 phase motor is measured by using two wattmeter method. The motor is running on full load with an efficiency of 86%. The readings of the two wattmeters are 255KW and 85KW. Determine i) The input power   ii)   The power factor   iii) The line current and   iv) The output power. **(08 Marks)**

c. Derive the emf. equation of an alternator. **(06 Marks)**

Module-5

9 a. Define Efficiency and voltage regulation of a transformer and give their equations. **(06 Marks)**

b. Explain the working of Star – Delta starter, with neat sketch for a 3 phase induction motor. **(06 Marks)**

c. A single phase 25 KVA, 1000/2000V, 50Hz transformer has a maximum efficiency of 98% at full load u.p.f. Determine its efficiency at i) 3/4th full load u.p.f   ii) ½ full load 0.8 p.f   iii) 1.25 full load 0.9 p.f. **(08 Marks)**

OR

10 a. Prove that the stator magnetic field has a constant magnitude and rotates at synchronous speed in an induction motor. **(08 Marks)**

b. Derive the e.m.f equation of a transformer. **(06 Marks)**

c. A 3 phase induction motor is wound for 4 pole and is supplied from 50Hz system. Calculate i) Synchronous speed   ii) The speed of the motor when slip is 4%   iii) The rotor current frequency when motor runs at 1440 rpm. **(06 Marks)**

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First/Second Semester B.E. Degree Examination, Dec.2016/Jan.2017
Basic Electronics

Time: 3 hrs.   Max. Marks:100

Note: *Answer FIVE full questions, selecting*
ONE full question from each module.

Module – 1

1   a.   Draw and explain the V-I characteristics of Si and Ge P-N junction diode. **(06 Marks)**
    b.   Draw and explain the negative voltage clamping circuit. **(06 Marks)**
    c.   The input to a half wave rectifier is given through a 10:1 transformer from a supply given by 230 Sin 314t V. If $R_f = 50\Omega$ and $R_L = 500\Omega$. Determine DC load voltage, RMS load voltage, Rectification efficiency, DC power delivered to the load. **(08 Marks)**

2   a.   With a neat circuit diagram and waveform, explain the working of full wave bridge rectifier. **(07 Marks)**
    b.   Find I_c and I_E for a transistor, given that $\alpha_{dc} = 0.96$ and $I_B = 110\mu A$. Also calculate the β_{dc} of the transistor. **(05 Marks)**
    c.   Draw the common emitter circuit and sketch the output characteristics, explain the operating regions by indicating them on the characteristic curve. **(08 Marks)**

Module – 2

3   a.   A fixed bias circuit has $V_{cc} = 10V$, $R_B = 220K\Omega$, $R_c = 1.2K\Omega$ and $\beta = 50$. Draw DC load line and mark Q-point. **(06 Marks)**
    b.   Explain the circuit operation and analysis of voltage divider bias. **(08 Marks)**
    c.   Write the ideal characteristics of an operational amplifier. **(06 Marks)**

4   a.   Design a inverting summing circuit with feedback $R_f = 100K\Omega$ using an OP-Amp to generate the output $V_o = -(3V_1+4V_2+5V_3)$ **(06 Marks)**
    b.   Draw an inverting and non-inverting amplifier using a OP-Amp and derive an expression for its output voltage. **(06 Marks)**
    c.   Show with a circuit diagram, how an OP-Amp can be used as difference/subtractor amplifier. **(08 Marks)**

Module – 3

5   a.   Convert :
         i) $(1010101)_2 = (?)_{10} = (?)_8$
         ii) $(ABCD)_{16} = (?)_2 = (?)_8$ **(05 Marks)**
    b.   Subtract $(111001)_2$ from $(101011)_2$ using 2's complement method. **(05 Marks)**
    c.   State and prove De-Morgan's theorem. **(05 Marks)**
    d.   Simplify and realize using basic gates
         $\overline{X}\,\overline{Y}\,\overline{Z} + \overline{X}\,\overline{Y}\,Z + \overline{X}\,Y + X\,\overline{Y}$ **(05 Marks)**

6   a.   Simplify and realize the following using NAND gates only $A\,\overline{B}\,\overline{C} + \overline{A}\,\overline{B}\,\overline{C} + \overline{A}\,\overline{B} + \overline{A}\,\overline{C}$. **(05 Marks)**
    b.   Define full adder, implement full adder using two half adders and write the equations for sum and carry. **(05 Marks)**
    c.   Implement EX-OR gate using only NOR gates. **(05 Marks)**
    d.   Realize the following using only NAND gates
         $Y = (A + \overline{B} + C)\cdot(\overline{A} + B + C)$. **(05 Marks)**

Module – 4

7   a.   Explain the working of clocked RS flip-flop.   (08 Marks)
    b.   Explain the architectural features of 8085.   (04 Marks)
    c.   Describe the block diagram of 8051 with neat diagram.   (08 Marks)

8   a.   Explain Flag register of 8051 microcontroller.   (05 Marks)
    b.   Give the comparison between Active and Passive transducer.   (05 Marks)
    c.   Explain the principle of operation of Resistance Temperature Detector (RTD).   (05 Marks)
    d.   Explain the construction of a Linear Variable Differential Transducer (LVDT).   (05 Marks)

Module – 5

9   a.   Derive an expression for modulation index in AM.   (06 Marks)
    b.   A 15KHz audio signal is used to frequency modulate a 100MHz carrier, causing deviation of 75KHz. Determine modulation index and Bandwidth of the FM signal.   (04 Marks)
    c.   Give the comparison between FM and AM.   (05 Marks)
    d.   Explain the block diagram of ISDN.   (05 Marks)

10 a.   Draw and explain the block diagram of optical fiber communication system.   (06 Marks)
    b.   Explain the basic principle of operation of mobile phones.   (06 Marks)
    c.   An audio frequency signal $10\sin 2\pi \times 500t$ is used to amplitude modulate a carrier of $50\sin 2\pi \times 10^5$. Calculate modulation index, sideband frequencies, Amplitude of each sideband frequency, bandwidth required.   (08 Marks)

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