First Semester B.E. Degree Examination, June /July 2016
Engineering Mathematics – I

Time: 3 hrs.   Max. Marks:100

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

PART – 1

1. a. Find the nth derivative of $e^{ax} \sin(bx + c)$.   **(07 Marks)**
   b. Find the pedal equation of the polar curve $r = a(1+ \cos \theta)$.   **(06 Marks)**
   c. Show that the radius of curvature at any point of the cycloid $x = a(t+ \sin t), y = a(1 - \cos t)$ is $4a \cos(t/2)$.   **(07 Marks)**

2. a. If $y = \tan^{-1}(x)$ then prove that $(1 + x^2) y_{n+2} + (2n + 1) xy_{n+1} + n(n + 1) y_n = 0$.   **(06 Marks)**
   b. Find the angle of intersection of curves : $r = \dfrac{a\theta}{1+\theta}$ and $r = \dfrac{\theta}{1+\theta^2}$.   **(07 Marks)**
   c. Derive an expression to find radius of curvature in pedal form.   **(07 Marks)**

PART – 2

3. a. Obtain Maclaurin's series for $\log(\sec x)$ upto the term containing x^6.   **(07 Marks)**
   b. If u is a homogeneous function of degree 'n' in x and y, then prove that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = nu$.   **(06 Marks)**
   c. If $u = f(r, s, t)$ and $r = \dfrac{x}{y}, s = \dfrac{y}{z}, t = \dfrac{z}{x}$ then prove that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} + z\dfrac{\partial u}{\partial z} = 0$.   **(07 Marks)**

4. a. Evaluate $\lim\limits_{x \to 0} \left(\dfrac{\tan x}{x} \right)^{1/x^2}$.   **(07 Marks)**
   b. Find the extreme value of $\sin x + \sin y + \sin (x+y)$.   **(06 Marks)**
   c. If $x = r \sin \theta \cos \phi, y = r \sin \theta \sin \phi, z = r \cos \theta$ then find $J\left(\dfrac{x \; y \; z}{r \; \theta \; \phi} \right)$.   **(07 Marks)**

PART – 3

5. a. A particle moves on the curve $x = 2t^2, y = t^2 - 4t, z = 3t - 5$ where t is time. Find the components of velocity and acceleration at $t = 1$ in the direction of $i - 3j + 2k$.   **(07 Marks)**
   b. Using differentiation under integral sign rule, evaluate $\int\limits_0^\infty e^{-x^2} \cos(\alpha x) \, dx$.   **(07 Marks)**
   c. Apply the general rules to trace a polar curve $r = a(1 + \cos \theta)$.   **(06 Marks)**

6. a. Find the angle between tangent planes $x \log z = y^2 - 1, x^2y - 2 - z = 0$ at point $(1, 1, 1)$.   **(07 Marks)**
   b. Show that $\vec{F} = (y^2 - z^2 + 3yz - 2x)i + (3xz + 2xy)j + (3xy - 2xz + 2z)k$ is both solenoidal and irrotational.   **(07 Marks)**
   c. Show that $\operatorname{div}(\operatorname{curl} \vec{F}) = 0$.   **(06 Marks)**

PART – 4

7 a. Obtain the reduction formula for $\int \sin^n x \, dx$. (07 Marks)

b. Solve $\sec x \tan x \tan y \, dx + \sec x \sec^2 y \, dy - e^x \, dx = 0$. (06 Marks)

c. Find the orthogonal trajectories of the family of curves $r^n = a^n \cos n\theta$. (07 Marks)

8 a. Evaluate : $\int_0^{2a} x^3 \sqrt{2ax - x^2} \, dx$. (07 Marks)

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

c. Suppose that an object is heated to 300°F and allowed to cool in a room whose air temperature is 80°F. After 10 minutes the temperature of the object is 250°F. What will be its temperature after 20 minutes? (07 Marks)

PART – 5

9 a. Find the rank of matrix :
$$A = \begin{bmatrix} 2 & -1 & 3 & 4 \\ 0 & 3 & 4 & 1 \\ 2 & 3 & 7 & 5 \\ 2 & 5 & 11 & 6 \end{bmatrix}.$$
(06 Marks)

b. Diagonalize the matrix $A = \begin{bmatrix} 4 & 1 \\ 2 & 3 \end{bmatrix}$. (07 Marks)

c. Use power method to find the largest eigen value and the corresponding eigen vectors of
$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$ taking initial eigen vectors $[1, 1, 1]$. (07 Marks)

10 a. Solve by Gauss elimination method :
$4x + y + z = 4$
$x + 4y - 2z = 4$
$3x + 2y - 4z = 6$. (07 Marks)

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

c. Solve by LU decomposition method the equations :
$3x + 2y + 7z = 4$
$2x + 3y + z = 5$
$3x + 4y + z = 7$. (07 Marks)

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First/Second Semester B.E. Degree Examination, June/July 2016
Engineering Chemistry

Time: 3 hrs.   Max. Marks: 100

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

Module – 1

1   a. Define reference electrode. Explain the measurement of single electrode potential using calomel electrode. Derive Nernst's equation for single electrode potential. **(05 Marks)**

     b. What are the types of electrodes? Explain briefly with an example for each. **(05 Marks)**

     c. What are batteries? Explain the following battery characteristics: (i) Cell potential (ii) Cycle life. **(05 Marks)**

     d. Describe the construction, working and application of Nickel-metal hydride battery. **(05 Marks)**

2   a. What are ion-selective electrodes? Explain the determination of pH of a solution using glass electrode. **(05 Marks)**

     b. What are concentration cells? Calculate the cell potential of the following cell at 298 K
$Ag / AgCl(0.01m) \| AgCl(0.5m)/Ag$ **(05 Marks)**

     c. Describe the construction and working of methanol-oxygen fuel cell. **(05 Marks)**

     d. Explain the construction, working and applications of $Li-MnO_2$ battery. **(05 Marks)**

Module – 2

3   a. Define the term corrosion. Explain pitting corrosion and water line corrosion. **(05 Marks)**

     b. Explain the following factors affecting rate of corrosion: (i) Nature of metal (ii) pH (iii) Corrosion product. **(05 Marks)**

     c. Explain decomposition potential and polarization with respect to electroplating. **(05 Marks)**

     d. Explain the process of electroplating of hard chromium. Give the reasons for not using chromium as anode. **(05 Marks)**

4   a. What is galvanization? Explain the process of galvanization. **(05 Marks)**

     b. What is cathodic protection? Explain sacrificial anode and impressed current method. **(05 Marks)**

     c. Explain how the following factors influence the rate of electro deposit:
i) Current density   ii) Throwing power. **(05 Marks)**

     d. What is electroless plating? Explain the process of electroless plating of copper on PCB. **(05 Marks)**

Module – 3

5   a. Explain the determination of calorific value of a solid/liquid fuel using Bomb Calorimeter. **(05 Marks)**

     b. What is knocking? Explain gasoline knocking mechanism with chemical reactions. **(05 Marks)**

     c. What is biodiesel? Give its synthesis. **(05 Marks)**

     d. Explain the construction and working of a PV-Cell. **(05 Marks)**

6   a. Define petroleum cracking. Explain fluidized catalytic cracking.   (05 Marks)
    b. Define the following: (i) Octane number   (ii) Power alcohol   (iii) Antiknocking agents
        (iv) Cetane number   (v) Bio-gas.   (05 Marks)
    c. Explain zone refining technique for purification of silicon and diffusion method.   (05 Marks)
    d. Calculate the gross and net calorific value of a sample of coal from the following data:
        Mass of coke = 0.98 g
        Mass of water = 2600 g,
        Water equivalent of calorimeter = 368 g,
        Specific heat of water = 4.187 J/g/K
        Rise in temperature = 2.8 K
        % of Hydrogen in the fuel sample = 5.8
        Latent heat of steam = 2454 J/g   (05 Marks)

Module – 4

7   a. Explain addition and condensation polymerization with suitable example to each.   (05 Marks)
    b. In a sample of a polymer 20% of molecules have molecular mass 15000 g/mol, 35% molecules have molecular mass 25000 g/mol, 45% molecules have molecular mass 20000 g/mol, calculate the number average and weight average molecular mass of a polymer.   (05 Marks)
    c. Give the synthesis, properties and applications of poly urethane.   (05 Marks)
    d. What are polymer composites? Explain the synthesis and properties of carbon fiber.
        (05 Marks)

8   a. Explain the free radical mechanism of addition polymerization of Vinyl chloride.   (05 Marks)
    b. What are adhesives? Explain the synthesis and properties of epoxy resin.   (05 Marks)
    c. What is glass transition temperature? Explain any three factors affecting T_g.   (05 Marks)
    d. What are conducting polymers? Explain the mechanism of conduction in polyaniline.
        (05 Marks)

Module – 5

9   a. What is Boiler feed water? Explain the corrosion of water boilers due to dissolved oxygen, CO_2 and mg Cl_2.   (05 Marks)
    b. Explain the Winkler's method of determining dissolved oxygen. Give the reactions involved.   (05 Marks)
    c. Discuss the gas condensation and hydrothermal process for the synthesis of nano materials.   (05 Marks)
    d. Give the synthesis, properties and application of carbon-nano tubes.   (05 Marks)

10 a. Explain the reasons for scale and sludge formation in water boilers. Mention its effects.
        (05 Marks)
    b. Define COD. If 20 cm³ of waste water sample consumes 30 cm³ of 0.01 N $K_2Cr_2O_7$ for oxidation of impurities, calculate COD value of water sample.   (05 Marks)
    c. Explain Sol-gel method for preparation of nanomaterial with an example.   (05 Marks)
    d. Give the structural features, properties and applications of fullerene.   (05 Marks)

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First / Second Semester B.E. Degree Examination, June/July 2016
Engineering Physics

Time: 3 hrs.   Max. Marks:100

Note: 1. *Answer FIVE full questions, selecting*
ONE full question from each module.
2. *Physical constants : $h = 6.624 \times 10^{-34}$ JS; $C = 3 \times 10^{8}$ m/s;*
$e = 1.6 \times 10^{-19}$ C.

Module – 1

1. a. What are the properties of matter waves? **(04 Marks)**
   b. Set up the time independent Schrodinger wave equation. **(06 Marks)**
   c. Define group velocity and phase velocity. Derive an expression for group velocity interms of phase velocity. **(06 Marks)**
   d. In a measurement that involved an inherent uncertainty of 0.003%, the speed of an electron was found to be 800 m/s. Calculate the corresponding uncertainty involved in determining its position. **(04 Marks)**

2. a. Obtain the solution of Schrodinger wave equation for a particle in a box of infinite height. **(07 Marks)**
   b. State and explain the physical significance of Heisenberg's uncertainty principle. **(03 Marks)**
   c. Discuss the black body radiation spectrum. **(06 Marks)**
   d. A particle of mass 0.5 MeV/C^2 has kinetic energy of 100 eV. Find its deBroglie wavelength where C is the velocity of light. **(04 Marks)**

Module – 2

3. a. What are the assumptions of classical free electron theory? Explain its failures (any two). **(06 Marks)**
   b. Explain the types of super conductors. **(04 Marks)**
   c. What is the law of mass action? Explain the electrical conductivity in semiconductors. **(06 Marks)**
   d. Calculate the Fermi velocity and mean free path for conduction electrons in Aluminium, given that its Fermi energy is 11.63 eV and relaxation time for electrons is 7.3×10^{-15} sec. **(04 Marks)**

4. a. Discuss the dependence of Fermi factor on temperature and on various energy levels. **(06 Marks)**
   b. Derive an expression for Fermi level in an Intrinsic semiconductor. **(06 Marks)**
   c. Explain the construction and working of Magleves. **(04 Marks)**
   d. The electron mobility and hole mobility of silicon are 0.17 m²/V-sec and 0.035 m²/V-sec respectively at room temperature. If the carrier density is known to be 1.1×10^{16} /m³, calculate the resistivity of silicon material. **(04 Marks)**

Module – 3

5 a. Derive an expression for energy density of radiation under equilibrium, in terms of Einstein's coefficient. (10 Marks)
   b. Explain various types of optical fibers. (06 Marks)
   c. A laser is emitting a beam with an average power of 4.5 mW. Find the number of photons emitted per second by the laser. The wavelength of the emitted radiation is 6328 $\overset{\circ}{A}$. (04 Marks)

6 a. What is laser? Explain the requisites of a laser system. (06 Marks)
   b. What is holography? Explain any one method of recording of the image of an object. (06 Marks)
   c. What is numerical aperture? Derive the expression for numerical aperture. (04 Marks)
   d. Find the attenuation in an optical fiber of length 500 m, when a light signal of power 100 mW emerges out of the fiber with a power of 90 mW. (04 Marks)

Module – 4

7 a. What is Bravais Lattice? Explain the seven crystal systems. (08 Marks)
   b. Derive Bragg's law. (04 Marks)
   c. Find the atomic packing factor for BCC and FCC. (04 Marks)
   d. Draw the following Miller planes in a cubic cell – (i) (110)   (ii) (102) (04 Marks)

8 a. Explain the construction and working of Bragg's X-ray spectrometer. (06 Marks)
   b. With a neat sketch, explain the salient features of Perouskites. (06 Marks)
   c. What is coordination number? Find the coordination number for FCC. (04 Marks)
   d. Calculate the glancing angle for incidence of X-rays of wavelength 0.58 $\overset{\circ}{A}$ on the plane (132) of NaCl which results in second order diffraction maxima taking the lattice spacing as 3.81 $\overset{\circ}{A}$. (04 Marks)

Module – 5

9 a. Define Mach number. Distinguish between acoustic, ultrasonic, subsonic and supersonic waves. (08 Marks)
   b. Explain general approaches of synthesis of nanomaterials. (08 Marks)
   c. Explain the applications of shock waves. (04 Marks)

10 a. What are shock waves? Explain the experimental method of producing shock waves. (08 Marks)
   b. What are carbon nanotubes? Explain any one method of synthesis of CNTs. (08 Marks)
   c. Explain any two applications of SEM. (04 Marks)

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First/Second Semester B.E. Degree Examination, June/July 2016
Programming in C and Data Structures

Time: 3 hrs.   Max. Marks:100

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

PART – A

1 a. What is pseudo-code? Compare it with an algorithm.   **(05 Marks)**
   b. Convert the following into 'C' expressions :

   i) x^{y^z} ii) $e^{|\sqrt{x}|}$ iii) $\dfrac{a \cdot b}{\sqrt{c \cdot d}}$ iv) $\sqrt{s(s-a)(s-b)(s-c)}$.   **(04 Marks)**

   c. Write a C program to find largest among three integers using ternary operators.   **(06 Marks)**
   d. Explain formatted input and output statements with examples.   **(05 Marks)**

2 a. Write structure of C program. List primitive data types with size and range.   **(10 Marks)**
   b. Define type casting. Explain with an example.   **(04 Marks)**
   c. Evaluate following (where i = 2, j = 3, k = 4 and a = 5) :
      i) a = i * (j /= k/i)   ii) a>> i % j   iii) i *= a / i % i.   **(06 Marks)**

PART – B

3 a. Write a C program to grade students result based on following conditions :
      i)   Marks < 35 grade "Fail"
      ii) 35 ≥ Marks < 60 grade "Second class"
      iii) 60 ≥ marks < 70 grade "First class"
      iv) 70≥ marks ≤ 100 grade "First class with distinction".   **(08 Marks)**
   b. Explain switch statement with an example.   **(07 Marks)**
   c. Write a note on goto statement.   **(05 Marks)**

4 a. Explain cascade if-else and nested if-else statements.   **(06 Marks)**
   b. Write a C program to implement simple calculator using operators +, −, * and /. Also handle
      divide by zero error. Use switch statement.   **(10 Marks)**
   c. What is dangling else problem? Explain how to handle this in C programming.   **(04 Marks)**

PART – C

5 a. Define array? How two dimension arrays are declared and initialized?   **(06 Marks)**
   b. Write a C program to generate Fibonacci numbers using arrays.   **(06 Marks)**
   c. Explain following string functions : i) strlen ii) strcpy iii) strcmp iv) strcat.   **(08 Marks)**

6 a. Explain various ways of passing parameters to the functions.   **(06 Marks)**
   b. Write a C program to find factorial of an integer using recursive function.   **(08 Marks)**
   c. Write a C program to find length of a string without using strlcn( ) function.   **(06 Marks)**

PART – D

7 a. Compare arrays with structures.   (06 Marks)
   b. Define structure. Explain it with an example.   (05 Marks)
   c. Explain the following :
       i)   typedef to define structure
       ii) Accessing structure members
       iii) Initialization of a structure.   (09 Marks)

8 a. Explain following file handling functions :
       i) fopen( )   ii) fclose( )   iii) fscanf( )   iv) fprintf( )   v) fseek( ).   (10 Marks)
   b. Write a C program to create a integer data file and then segregate odd and even integers into
       two different files.   (10 Marks)

PART – E

9 a. What is pointer? Explain with program.   (06 Marks)
   b. Explain the following :
       i) #define   ii) #include   iii) nesting of macro   iv) argumented macro.   (10 Marks)
   c. Explain malloc and calloc functions.   (04 Marks)

10 a. What is stack? Explain. Write its applications.   (08 Marks)
    b. Explain queue and write its applications.   (08 Marks)
    c. Write a note on trees.   (04 Marks)

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First/Second Semester B.E. Degree Examination, June/July 2016
Basic Electrical Engineering

Time: 3 hrs.   Max. Marks: 100

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

Module-1

1   a.   An 8Ω resistor is in series with a parallel combination of two resistors 12Ω and 6 Ω. If the current in 6 Ω resistor is 5A, determine the total power dissipiated in the circuit.   (06 Marks)
    b.   Obtain the potential difference V_{xy} in the following circuit.   (06 Marks)

Fig. Q1(b)

    c.   Explain statically induced emf and dynamically induced emf with relevant diagrams and equations.   (08 Marks)

OR

2   a.   Two coils, A of 13000 turns and B of 14000 turns lie in parallel planes so that 55% of the flux produced by coil A links coil B. A current of 6A in A produces 0.05mwb, while the same current in B produces 0.075mwb. Calculate i) Mutual Inductance and ii) the coefficient of coupling.   (08 Marks)
    b.   Calculate the supply voltage V in the circuit shown   (06 Marks)

Fig. Q2(b)

    c.   Derive an equation for energy stored in a magnetic field of a coil.   (06 Marks)

Module-2

3   a.   Explain the significance of Back emf in case of a DC motor.   (06 Marks)
    b.   Explain with a neat sketch, the constructional features and operation of an induction type single phase energy meter.   (06 Marks)
    c.   A 4 pole, 100V shunt generator with lap connected armature, having field and armature resistance of 50Ω and 0.1Ω respectively, supplies a load of sixty lamps each lamp rated 100V, 40W. Calculate the total armature current, the current per path and the generated emf. Allow a contact drop of 1 volt per brush.   (08 Marks)

OR

4   a.   Derive equation of Induced EMF for DC Generator.   (06 Marks)
    b.   List out applications of shunt and series DC motors.   (06 Marks)
    c.   A series motor runs at 600Rpm when taking a current of 110A from a 230V supply. The usefull flux per pole for 110A is 24mwb and that for 50A is 16mwb. The armature resistance and series field resistance are 0.12Ω and 0.03Ω respectively. Calculate the speed when the current has fallen to 50A.   (08 Marks)

Module-3

5 a. Obtain an expression for the voltage across pure inductor if the current through it is $i = I_m \sin wt$. **(06 Marks)**

   b. Explain working of two way control and three way control of lamps with neat sketch. **(06 Marks)**

   c. A choke coil takes a current of 2A lagging 60° behind the applied voltage of 200V at 50Hz. Calculate the inductance resistance and impedance of the coil. Also determine the power consumed when it is connected across 100V 25Hz supply. **(08 Marks)**

OR

6 a. Deduce a condition at which an RLC circuit behaves like a resistive circuit. State whether the current in the circuit is minimum or maximum. **(06 Marks)**

   b. Find an expression for the current and calculate power when a voltage $v = 300\sin 100\pi t$ is applied to a coil having $R = 60\Omega$ and $L = 0.16$. **(08 Marks)**

   c. Write a short note on earthing, its objectives and mention the types of earthing. **(06 Marks)**

Module-4

7 a. Explain the advantages of rotating field type alternator. **(06 Marks)**

   b. A 3phase, 4pole, star connected alternator has 24 slots with 12 conductors per slot and flux per pole of 0.1wb. Calculate the line emf generated when the alternator is run at 1500rpm. Given that $K_d = 0.966$ and $K_p = 1$ **(08 Marks)**

   c. During the measurement of power by two wattmeter method, the total input power to a 3phase, 440V motor running at a power factor of 0.8 was found to be 25kW. Find the readings of the two wattmeters. **(06 Marks)**

OR

8 a. Show that two wattmeters are sufficient to measure three phase power. **(06 Marks)**

   b. Derive an emf equation of a three phase synchronous generator. **(06 Marks)**

   c. A balanced star connected 3 phase load is fed from 3 phase, 400V supply. The line current is 20A and the total power absorbed by the load is 10kW. Calculate:
   i)   The impedance in each branch
   ii) The power factor and
   iii) The total power consumed if the same impedances are star connected. **(08 Marks)**

Module-5

9 a. Explain principle operation of transformer and hence deduce the emf equation of the transformer. **(08 Marks)**

   b. Explain principle operation of 3phase induction motor. **(06 Marks)**

   c. The maximum efficiency at full load and unity power factor of a single phase 25KVA, 500/1000V, 50Hz transformer is 98%. Determine its efficiency at
   i)   75% load 0.9 p.f and
   ii) 50% load 0.8 p.f **(06 Marks)**

OR

10 a. What are the losses in a transformer and how they vary with load? Deduce a condition for maximum efficiency. **(06 Marks)**

   b. Explain the necessity of star – delta starter for the induction motor. With circuit diagram, explain a star delta starter. **(08 Marks)**

   c. An 8 pole alternator runs at 750rpm and supplies power to a 6 pole induction motor which runs at 970rpm. What is the slip of induction motor? **(06 Marks)**

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First/Second Semester B.E. Degree Examination, June/July 2016
Basic Electronics

Time: 3 hrs.   Max. Marks:100

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

PART – A

1 a. Name the Junction Breakdowns in Diodes. Explain them briefly.   (05 Marks)
   b. A 4.3V zener diode is connected in series with 820Ω resistor and DC supply voltage of 12V. Find the diode current and the power dissipation.   (05 Marks)
   c. What is ripple factor? Derive an expression for ripple factor in case of 2-diode full wave rectifier.   (05 Marks)
   d. Describe about series noise clipper.   (05 Marks)

2 a. What are the three transistor configurations? Compare and contrast the characteristics of these configurations. State any one application of each of these configuration.   (06 Marks)
   b. With a neat diagram, explain the operation of N-P-N transistor.   (05 Marks)
   c. Find α_{DC}, I_B, β_{DC} for transistor with $I_C = 2.5$ mA and $I_E = 2.55$ mA.   (03 Marks)
   d. A half-wave rectifier DC power supply has to supply 20V to a 500Ω load. The peak-peak ripple voltage should not exceed 10% of the average output voltage and the a.c. input frequency is 60Hz. Calculate the required capacitor value.   (06 Marks)

PART – B

3 a. Sketch a voltage divider bias circuit using a NPN transistor. Explain the operation of the circuit and write the approximate equations for V_B, I_B, I_C and V_{CE}.   (08 Marks)
   b. What is the need for transistor biasing? Give a brief account on thermal stability of bias circuits.   (07 Marks)
   c. A base bias circuit with $V_{CC} = 18$V uses a transistor with $V_{BE} = 0.7$V. The circuit is to have $V_{CE} = 9$V and $I_C = 2$ mA. Plot the Q-point. Determine the required value of R_C.   (05 Marks)

4 a. Describe about OP-AMP as summing amplifier. Determine the V_O for the circuit shown in Fig.Q.4(a).   (05 Marks)
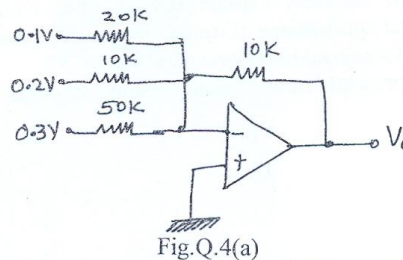
Fig.Q.4(a)

   b. Pertaining to OPAMP explain about slew rate and CMRR. An OPAMP has an open loop voltage gain of 10^4 and a common mode voltage gain of 0.1. Express the CMRR in dB.   (08 Marks)
   c. Give the block diagram of a typical OPAMP, explain its various constituents. Also list the properties of an ideal OP-AMP.   (07 Marks)

PART – C

5 a. What is the speciality of NAND and NOR gates? Realize: i) OR gate using NAND gate; ii) AND gate using NOR gate. **(05 Marks)**

   b. Simplify $Y = AB + ABC + \overline{A} B + A \overline{B} C$ and construct logic circuit. **(04 Marks)**

   c. Prove the following Boolean identity using truth table:

   i) $A + AB = A$ ii) $A + \overline{A} B = A + B$. **(04 Marks)**

   d. Design full adder circuit using three variables and implement it using two half adders. **(07 Marks)**

6 a. i)   Convert A6B.F5 to binary.

   ii)   Convert binary 110.111 into decimal equivalent. **(06 Marks)**

   b. Perform the subtraction with the following binary numbers using 1's complement and 2's complement method: i) 11010 – 1101   ii) 10010 – 10011. **(06 Marks)**

   c. Construct OR and AND using diodes. Explain the both. **(08 Marks)**

PART – D

7 a. Explain the architecture of 8085 microprocessor with a neat schematic. **(10 Marks)**

   b. List the features of 8051 microcontroller. **(05 Marks)**

   c. What is LVDT? Explain its working and enumerate its applications. **(05 Marks)**

8 a. Realize R.S. flip flop using NAND gates. **(05 Marks)**

   b. Give an elaborate account on piezoelectric transducer. **(08 Marks)**

   c. List the differences between microprocessors and microcontrollers. **(05 Marks)**

   d. Write any four desirable properties of a good transducer. **(02 Marks)**

PART – E

9 a. What is modulation? Derive an expression for instantaneous voltage of amplitude modulated wave. **(05 Marks)**

   b. Mention the advantages of FM. **(05 Marks)**

   c. A 1MHz carrier is amplitude modulated by a 40kHz modulating signal with a modulation index of 0.5. The unmodulated carrier is having a power of 1kW. Calculate the power of the amplitude modulated signal. Also find the side band frequencies. **(05 Marks)**

   d. Explain the process of demodulation of AM signal. **(05 Marks)**

10 a. With a block diagram, explain optical fiber communication system. Also enumerate advantages and applications of optical fiber communication system. **(10 Marks)**

   b. Explain about switched telephone network. **(06 Marks)**

   c. Describe the principle of operation of mobile phones. **(04 Marks)**

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First/Second Semester B.E. Degree Examination, June/July 2016
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs.   Max. Marks: 100

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

Module-1

1 a. Explain briefly the role of civil engineer in the infra–structural development of nation.
                                                                    (10 Marks)
   b. Classify the roads and dams and draw the neat sketches.   **(10 Marks)**

OR

2 a. State and explain principle of transmissibility of forces.   **(04 Marks)**
   b. Define couple and explain various characteristics of couple. **(08 Marks)**
   c. A 100 N vertical force is applied to the end of lever which is attached to a shaft as shown in Fig. Q2(c), determine :
       i)   The moment of force about 'O'
       ii) The horizontal force applied at 'A' which creates same moment about 'O'
       iii) The smallest force applied at 'A' which creates same moment about 'O'.   **(08 Marks)**

Module-2

3 a. Distinguish between resolution and composition of forces.   **(04 Marks)**
   b. State and prove parallelogram law of forces.   **(06 Marks)**
   c. Three forces acting on a hook are as shown in Fig. Q3(c). Determine the direction of the fourth force of magnitude 100 N such that the hook is pulled in x – direction only. Determine the resultant force in x-direction.   **(10 Marks)**

OR

4 a. State and prove Varignon's theorem of moments.   **(08 Marks)**
   b. A rigid plate ABCD is subjected to forces as shown in Fig. 4(b). Compute the magnitude, direction and line of action of the resultant of the system with reference to the point A.
                                                                    (12 Marks)

Module-3

5 a. State and prove Lami's theorem.   **(04 Marks)**
   b. What is meant by equilibrium of a rigid body? State the conditions of static equilibrium for coplanar concurrent and non – concurrent force systems.   **(08 Marks)**
   c. Two identical rollers each weighting 200 N are pulled in a trough as shown in Fig. Q5(c). Assuming all contact surfaces are smooth, find the reactions developed at contact surfaces A, B, C and D.   **(08 Marks)**

OR

6 a. List the Law's of friction.   **(06 Marks)**
   b. Define : i) Angle of repose   ii) Angle of friction
               iii) coefficient of friction   iv) cone of friction.   **(08 Marks)**
   c. What is the value of 'P' in the system shown in Fig. Q6(c) to cause the motion to impend? Assume the pulley is smooth and the coefficient of friction between the other contact surfaces is 0.2.   **(06 Marks)**

Module-4

7   a. Locate the Centroid of area shown in Fig. Q7(a) with respect to the Cartesian coordinate system shown. **(10 Marks)**

   b. Distinguish between centriod and centre of gravity. **(04 Marks)**

   c. Derive the expression for the centriod of the semi – circular lamina from the diametric axis. **(06 Marks)**

OR

8   a. State and prove parallel axis theorem. **(06 Marks)**

   b. Determine the second moment of area about the horizontal centroidal axis as show in Fig. 8 (b). Also find radius of gyration. **(14 Marks)**

Module-5

9   a. Define the following terms : i) Projectile   ii) Angle of projectile   iii) Vertical height   iv) Time of flight   v) Horizontal range. **(10 Marks)**

   b. A feather is dropped on the moon from a height of 1.40m. The acceleration of gravity on the moon is 1.67m/s^2. Determine the time for the feather to fall to the surface of the moon. **(10 Marks)**

OR

10 a. Briefly explain abut : i) Super elevation   ii) relative motion   iii) motion under gravity   iv) centrifugal force. **(10 Marks)**

   b. A ball is thrown vertically upward with a speed of 25 m/s :
   i)   How high does it rise?
   ii) How long does it take to reach its highest point?
   iii) How long does the ball take to hit the ground after it reaches its highest point?
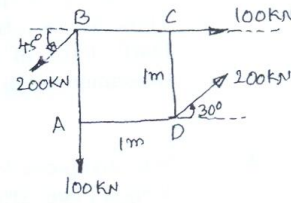   iv) What is the velocity when it returns to the level from which it started? **(10 Marks)**
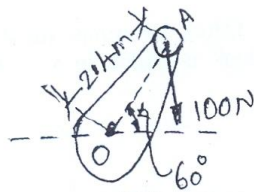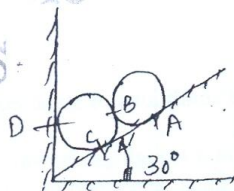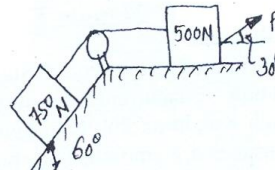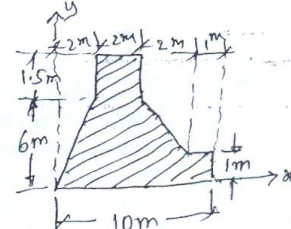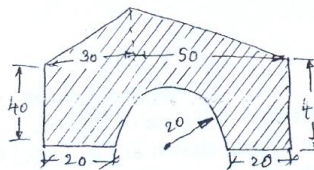

Fig. Q2(c)
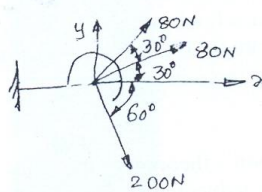
Fig. Q3(c)

Fig. Q4(b)

Fig. Q5(c)

Fig. Q6(c)

Fig. Q7(a)

Fig. Q8(b)

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2 of 2

First/Second Semester B.E. Degree Examination, June/July 2016
Elements of Mechanical Engineering

Time: 3 hrs.   Max. Marks:100

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

PART – A

1 a. Explain with neat sketch Fossil fuel cell system. (06 Marks)
    b. Explain advantages and disadvantages of renewable energy resources. (06 Marks)
    c. What is solar energy? Define the three principal solar energy conversion processes. (08 Marks)

2 a. Explain different states of steam. (08 Marks)
    b. With neat sketch, explain classification of boiler and mention the difference between them. (08 Marks)
    c. Define the following: i) Super heater; ii) Air preheater; iii) Steam trap; iv) Blowoff valve or cock. (04 Marks)

PART – B

3 a. Differentiate between reaction and impulse steam turbine. (08 Marks)
    b. With neat sketch, explain principle operation of closed and open cycle gas turbine. (12 Marks)

4 a. Explain the working of 2-stroke petrol engine. (10 Marks)
    b. The following observations were obtained during a trial on a 4-stroke diesel engine:
       Cylindrical diameter = 25cm
       Stroke of the piston = 40cm
       Crankshaft speed = 250 rpm
       Brake load = 70 kg
       Brake drum diameter = 2m
       Mean effective pressure = 6 bar
       Diesel oil consumption = 0.1 m^3/min
       Specific gravity of diesel = 43900 kJ/kg.
       Find: i) Brake power; ii) Mechanical efficiency; iii) Indicated power; iv) Brake thermal efficiency; v) Frictional power; vi) Indicated thermal efficiency. (10 Marks)

PART – C

5 a. What is drilling? Mention different types of drilling machines. (08 Marks)
    b. With neat sketch, explain classification robots based on configuration. (12 Marks)

6 a. With neat sketch, explain the following: i) End milling; ii) Slot milling. (06 Marks)
    b. Define automation, explain different types of automation. (05 Marks)
    c. With neat sketch explain the following: i) Boring; ii) Counter sinking; iii) Spot facing. (09 Marks)

PART – D

7 a. Define fusion welding. Explain working principle of arc welding. (10 Marks)

  b. What are the applications of composite materials in aerospace and automotive industries? (10 Marks)

8 a. What is soldering? What are the different method of soldering? (07 Marks)

  b. Differentiate between soldering and brazing. (06 Marks)

  c. Explain the types of oxy-acetylene flames. (07 Marks)

PART – E

9 a. What is refrigeration? Describe parts of refrigeration with neat sketch. (10 Marks)

  b. With neat sketch, explain principle of air conditioning. (10 Marks)

10 a. Describe working principle of vapour absorption refrigerator. (10 Marks)

  b. Explain thermodynamic and physical properties of good refrigerator. (06 Marks)

  c. Define the following: i) Air conditioning; ii) Central air conditioning. (04 Marks)

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Second Semester B.E. Degree Examination, June/July 2016
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 the boundary value problem,
$y'' + 4y' + 4y = 8x^2$. Given $y(0) = 1, y'(0) = 2$ **(07 Marks)**

    b. Solve : $y'' + 4y = x^2 + \cos 2x + 2^{-x}$.   **(06 Marks)**

    c. Solve by method of undetermined coefficients $y'' - 5y' + 6y = 2e^x + 4\cos 2x$.   **(07 Marks)**

2   a. Solve the following differential equation by the method of variation of parameters:

$y'' - 2y' + y = \dfrac{e^x}{x}$.   **(07 Marks)**

    b. Solve $y'' - 2y' + y = xe^x + x$.   **(06 Marks)**

    c. Solve $(D^3 + D^2 - 4D - 4)y = 3e^{-x} - 4x - 6$.   **(07 Marks)**

Module – 2

3   a. Solve the system of differential equations, $\dfrac{dx}{dt} + 2y = e^t$; $\dfrac{dy}{dt} - 2x = e^{-t}$.   **(07 Marks)**

    b. Solve for P, given that
$P^2 + 2PY \cot x = y^2$ **(06 Marks)**

    c. Solve the Legendre's Linear differential equation,
$(2x + 1)^2 y'' - (2x + 1)y' - 12y = x \log(2x + 1)$.   **(07 Marks)**

4   a. Find the general and singular solution of the differential equation $y = px + \sqrt{a^2 p^2 + b^2}$.   **(07 Marks)**

    b. Solve $x^2 y'' + 5xy' + 13y = \log x + x^2$.   **(06 Marks)**

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

Module – 3

5   a. Form a partial differential equation by eliminating the arbitrary function from the relation,
$f(x^2 + 2yz, y^2 + 2zx) = 0$ **(07 Marks)**

    b. Derive one dimensional wave equation.   **(06 Marks)**

    c. Evaluate $\displaystyle\int_0^3 \int_1^{\sqrt{4-y}} (x + y)\,dx\,dy$, by changing the order of integration.   **(07 Marks)**

6   a. Obtain the solution of heat equation by variable separable method.   **(07 Marks)**

    b. Evaluate $\displaystyle\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z}\,dz\,dy\,dx$ **(06 Marks)**

    c. Solve the equation, $\dfrac{\partial^2 z}{\partial x^2} - 2\dfrac{\partial z}{\partial x} + 2z = 0$, Given that $z = e^y$ and $\dfrac{\partial z}{\partial x} = 0$, where $x = 0$ **(07 Marks)**

Module – 4

7   a. Obtain the relation between Beta and Gamma function, $B(m,n) = \dfrac{\Gamma m \, \Gamma n}{\Gamma m + n}$ (07 Marks)

   b. Prove that the cylindrical co-ordinates system is orthogonal. (06 Marks)

   c. Using triple integral find the volume of the tetrahedron bounded by the planes,
   $x = 0, y = 0, z = 0$ and $\dfrac{x}{a} + \dfrac{y}{b} + \dfrac{z}{c} = 1$. (07 Marks)

8   a. Find the divergence of the vector,
   $f = (\cos\phi + \sin\phi)e_R + (\cos\phi - \sin\phi)e_\phi + e_z$
   Given in cylindrical polar co-ordinates. (07 Marks)

   b. Find the area bounded by the area of the ellipse,
   $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$, in the first quadrant. (06 Marks)

   c. Evaluate by using Beta and Gamma function,
   $\displaystyle\int_0^a y^4 \sqrt{a^2 - y^2}\,dy$. (07 Marks)

Module – 5

9   a. Find the Laplace transform of,
   i) $te^{-2t}\sin 4t$ ii) $\dfrac{1 - \cos t}{t}$. (07 Marks)

   b. Find the solution of differential equation that represents the damped harmonic motion of the spring mass system,
   $\dfrac{d^2 y}{dt^2} + 4\dfrac{dy}{dt} + 8y = 0$, with $y(0) = 2$, $y'(0) = 0$ (06 Marks)

   c. Using convolution theorem find the inverse Laplace transforms,
   $F(s) = \dfrac{s}{(s-1)(s^2 + 4)}$ (07 Marks)

10 a. Find the Laplace transform of the periodic function with period 2a:
   $f(t) = \begin{cases} t & ; \text{ for } 0 < t < a \\ 2a - t & ; \text{ for } a < t < 2a \end{cases}$
   Draw the graph of the output function. (07 Marks)

   b. Find $L^{-1}\left\{ \dfrac{7s + 4}{4s^2 + 4s + 9} + \dfrac{1}{(s+3)^4} \right\}$. (06 Marks)

   c. Express the following function in terms of unit step function and hence find its Laplace-Transform,
   $f(t) = \begin{cases} 1 & ; \ 0 < t < 1 \\ 2t & ; \ 1 < t \le 2 \\ 3t^2 & ; \ t \ge 2 \end{cases}$. (07 Marks)

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