Total No. of Questions : 9]

SEAT No. :

P-3926

[Total No. of Pages : 5

[6001]-4001

F.E.

ENGINEERING MATHEMATICS - I

(2019 Pattern) (Semester - I) (107001)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Question No. 1 is compulsory.***
2) ***Solve Q. No. 2 or Q. No. 3, Q. No. 4 or Q. No. 5, Q. No. 6 or Q. No. 7, Q. No. 8 or Q. No. 9.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) Write the correct option for the following multiple choice questions :

a) If $u=\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{x^2+y^2}$ then $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$ is equal to **[2]**

i) 2u ii) –2u

iii) 0 iv) None

b) If $u = x^y$ then $\frac{\partial u}{\partial y}$ is equal to **[1]**

i) 0 ii) yx^{y-1}

iii) $x^y \log x$ iv) x^{y-1}

c) If $x = uv$, $y=\frac{u}{v}$ then the value of $\frac{\partial(u,v)}{\partial(x,y)}$ is **[2]**

i) $\frac{-2u}{v}$ ii) uv

iii) $\frac{v}{2u}$ iv) $\frac{-v}{2u}$

P.T.O.

d) A is orthogonal matrix then A^{-1} equal to **[1]**

i) A
ii) A^T
iii) A^2
iv) 1

e) For what value of K the homogeneous system $x + 2y - z = 0$, $3x + 8y - 3z = 0$; $2x + 4y + (k-3)z = 0$ has infinitely many solution. **[2]**

i) K = 0
ii) K = 1
iii) K = 2
iv) K = 3

f) Using Cayley Hamilton theorem A^{-1} for the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ is calculated from **[2]**

i) $\frac{1}{5}(-A - 4I)$
ii) $\frac{1}{5}(A - 4I)$
iii) $\frac{1}{5}(A + 4I)$
iv) $\frac{1}{5}(4I - A)$

Q2) a) If $u = ln(x^2 + y^2)$, show that $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$. **[5]**

b) If $e^{2u} = y^2 - x^2$, $\operatorname{cosec} v = \frac{y}{x}$ then find the value of **[5]**

$$\left(x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}\right).\left(x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}\right)$$

c) If $u = f(x - y, y - z, z - x)$ then find the value of $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z}$. **[5]**

OR

Q3) a) If $u = ax + by$, $v = bx - ay$ find the value of $\left(\frac{\partial u}{\partial x}\right)_y . \left(\frac{\partial x}{\partial u}\right)_v$. **[5]**

b) If $T = \sin\left(\frac{xy}{x^2 + y^2}\right) + \sqrt{x^2 + y^2}$, find the value of $x\frac{\partial T}{\partial x} + y\frac{\partial T}{\partial y}$. **[5]**

c) If $u = f(r, s)$ where $r = x^2 + y^2$, $s = x^2 - y^2$ then show that $y\frac{\partial u}{\partial x} + x\frac{\partial u}{\partial y} = 4xy\frac{\partial u}{\partial r}$. **[5]**

Q4) a) If $x = u + v$, $y = v^2 + w^2$, $z = u^3 + w^3$ then find $\frac{\partial u}{\partial x}$. **[5]**

b) In calculating resistance R of a circuit by using the formula :

$$R = \frac{V}{I}$$

errors of 3% and 1% are made in measuring Voltage V and current I respectively. Find the % error in the calculated resistance. **[5]**

c) Discuss the maxima and minima of : **[5]**

$f(x, y) = x^2 + y^2 + xy + x - 4y + 5$

OR

Q5) a) If $u + v^2 = x$, $v + w^2 = y$, $w + u^2 = z$ find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$. **[5]**

b) Examine for functional dependence : **[5]**

$u = y + z$, $v = x + 2z^2$, $w = x - 4yz - 2y^2$

c) A space probe in the shape of the ellipsoid $4x^2 + y^2 + 4z^2 = 16$ enters the earth's atmosphere and it's surface begins to heat. After one hour, the temperature at the point (x, y, z) on the surface of the probe is

$T(x, y, z) = 8x^2 + 4yz - 16z + 600$.

Find the hottest point on the surface of the probe, by using Lagrange's method. **[5]**

Q6) a) Examine for consistency and if consistent then solve it **[5]**

$2x + 3y + 5z = 1$; $3x + y - z = 2$; $x + 4y - 6z = 1$

b) Examine whether the vectors **[5]**

$X_1 = (1, 1, -1, 1)$; $X_2 = (1, -1, 2, -1)$; $X_3 = (3, 1, 0, 1)$

are linearly independent or dependent. If dependent find relation between them.

c) If $A = \begin{bmatrix} 1/3 & 2/3 & a \\ 2/3 & 1/3 & b \\ 2/3 & -2/3 & c \end{bmatrix}$ is orthogonal **[5]**

Find a, b, c.

OR

Q7) a) Investigate for what values of k, the equations **[5]**

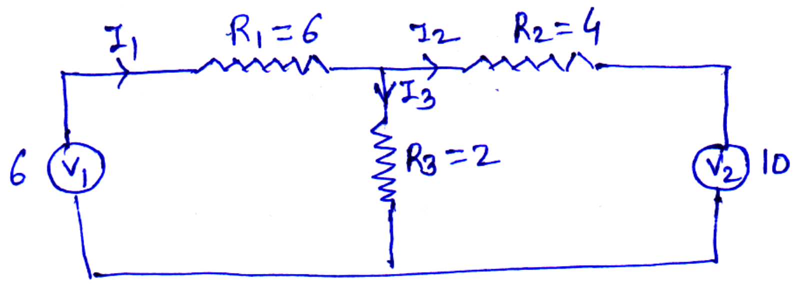
$x + y + z = 1$; $2x + y + 4z = k$; $4x + y + 10z = k^2$ have infinite number of solution? Hence find solution.

b) Examine whether the vectors. **[5]**

$X_1 = (2, 3, 4, -2)$; $X_2 = (-1, -2, -2, 1)$; $X_3 = (1, 1, 2, -1)$

are linearly independent or dependent. If dependent find relation between them.

c) Find the current I_1; I_2; I_3 in the circuit shown in the figure **[5]**



Q8) a) Find eigen values and eigen vectors of the following matrix **[5]**

$$A = \begin{bmatrix} 1 & 1 & -2 \\ -1 & 2 & 1 \\ 0 & 1 & -1 \end{bmatrix}$$

b) Verify Cayley-Hamilton theorem for $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ and use it to find A^{-1}. **[5]**

c) Find the modal matrix p which transform the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ to the diagonal form. **[5]**

OR

Q9) a) Find eigen values and eigen vectors of the following matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$. **[5]**

b) Verify Cayley-Hamilton theorem for $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$ and use it to find A^{-1}. **[5]**

c) Reduce the following quadratic form to the "sum of the squares form". **[5]**

$Q(x) = 2x^2 + 9y^2 + 6z^2 + 8xy + 8yz + 6xz$

□□□

Total No. of Questions : 9]

SEAT No. :

P-3919

[Total No. of Pages : 4

[6001]-4002
F.E.
ENGINEERING PHYSICS
(2019 Pattern) (Semester - II) (Credit System) (107002)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) *Question No. 1 is compulsory.*
2) *Q.No. 2 to Q.No. 9 carry equal marks.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*
5) *Use of electronic calculator is allowed.*

Physical Constants :

1) *Mass of electron* $m_e = 9.1 \times 10^{-31}$ kg
2) *Charge on electron* $e = 1.6 \times 10^{-19}$c
3) *Planek's constant* $h = 6.63 \times 10^{-34}$J-sec.

Q1) Write correct option of given questions with Answer. (1 mark each) : **[10]**

i) According to Dr. Broglies hypothesis, the wavelength $\lambda = \frac{h}{p}$ is applicable for

a) Photons
b) Matter particles
c) Either matter particles or photons
d) Both matter particles and photons

ii) According to Heisenberg's uncertainty principle -

a) $\Delta x.\Delta p \geq \frac{h}{2n}$ b) $\Delta x.\Delta p \leq \frac{h}{2n}$

c) $\Delta x.\Delta p \geq \frac{h}{6n}$ d) $\Delta x.\Delta p \leq \frac{h}{4n}$

iii) In Schrodinger's time independent equation ______ of a particle is independent of time.

a) Kinetic energy b) Potential energy

c) Total energy d) Wave function

iv) Fermi level for a metal or conductor is highest energy level occupied by electrons at ______.

a) 0ºC b) 0ºF

c) 0ºK d) None of the above

v) Hall effect is true for ______.

a) Metals only

b) Semiconductors only

c) For N-type semiconductors only

d) Both metal and semiconductors

vi) The magnetic materials exhibit the property of magnetisation because of ______.

a) Orbital motion of electrons b) Spin of electrons

c) Spin of nucleus d) All of the above

vii) A superconductor is a perfect ______ material.

a) Insulator b) Semiconductor

c) Dielectric d) Diamagnetic

viii) Tunneling of Cooper pairs through an insulating layer between two superconductors is called ______.

a) Josephson effect b) Onnes effect

c) Meissner effect d) Kerr effect

ix) With increase in size of nanoparticles its hardness ______.

a) Increases b) Decreases

c) Remains same d) Difficult to predict

x) In Non destructive testing (NDT) the physical and chemical properties of sample ______.

a) Changes b) Do not changes

c) Depends on temp d) Does not depend on temp

Q2) a) Deduce Schrodinger's time independent wave equation. **[6]**

b) State and explain Heisenberg's uncertainty principle using the except of small and large wave packet. **[5]**

c) Calculate the energy difference between the ground state and first excited state of an electron in the rigid box of length 1A°. **[4]**

OR

Q3) a) State De Broglie's hypothesis. Derive an expression for De Broglies wavelength of an elctron accelerated by a potential difference of 'V'. **[6]**

b) Define wave function. Write the conditions of well behaved wave function. **[5]**

c) The uncertainty in the location of a particle is equal to its De Broglie wavelength. Show that the uncertainty in the velocity to a particle is equal to the particle velocity itself. **[4]**

Q4) a) With the help of bond theory of solids explain the classification of solids into conductors, semiconductors and insulators. **[6]**

b) What are solar cells? Draw I-V characteristics of solar cells and define the terms i) Short circuit current and ii) Open circuit voltage. **[5]**

c) The Hall coefficient of a specimen of a doped silicon is found to be 3.66×10^{-4} m^3/c. The resistivity of the specimen is 1×10^{-2} Ωm. Determine the mobility of the charge carriers. **[4]**

OR

Q5) a) Explain the Hall effect with a neat labelled diagram. Derive an expression for Hall voltage. **[6]**

b) Define Fermi level in semiconductors. For a P-N junction diode draw energy band picture showing the position of Fermi level in i) Zero bias and ii) Forward bias. **[5]**

c) Calculate the number of donors atoms which must be added to an intrinsic semiconductors to obtain the resistivity of 10^{-6} Ωcm. (Given mobility of electrons = 1000 cm^2/V sec.) **[4]**

Q6) a) Differentiate between diamagnetism, paramagnetism and ferromagnetism. (Any two points) **[6]**

b) Define : **[5]**

i) Magnetic permeability and

ii) Magnetic susceptibility

Obtain the relation between them.

c) The critical magnetic field of niobium is 1×10^5 A/m at 8ºK and 2×10^5 A/m at 0ºK. Calculate the critical temperature of the element. **[4]**

OR

Q7) a) Explain artificial magnetic field in brief. Distinguish between Type-I & Type II superconductors. (Any 3 points). **[6]**

b) Explain Melssner effect in brief. Show that superconductors are characterised by perfect diamagnetism. **[5]**

c) Define the terms : **[4]**

i) Magnetic field strength (H)

ii) Magnetic induction (B)

iii) Magnetisation (M)

iv) Relation permeability (μ_r)

OR

Q8) a) What is echosounding technique? Using this technique explain non destructive testing for the measurement of thickness of a metal sheet using ultrasonic waves. **[6]**

b) What is Non Destructive Testing (NDT)? Distinguish between Non Destructive Testing and Destructive Testing. (Any two points) **[5]**

c) Write any four applications of nanotechnology in the field of automobile. Explain any one in brief. **[4]**

OR

Q9) a) Explain optical and mechanical properties of nanoparticles. **[6]**

b) What are nanoparticles? What is the effect of quantum confinement on the properties of nanoparticles? **[5]**

c) An ultrasonic pulse is sent through a copper block. The echo pulse is received after 4 μs. If velocity of ultrasonic in copper is 5000 m/s, calculate the thickness of copper block. If the reflection pulse recorded after 1.253 μs from the top what is the location of flaws? **[4]**

▽▽▽▽

Total No. of Questions : 9]

SEAT No. :

P-3920

[Total No. of Pages : 4

[6001]-4003

F.E.

ENGINEERING CHEMISTRY

(2019 Pattern) (Semester - I/II) (107009)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates :

1) ***Question No. 1 is compulsory.***
2) ***Solve any one of Q.2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q.9.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) Multiple Choice Questions :

i) Electroluminiscent polymers are used in : **[1]**
   a) Solar cell technology b) Digital display
   c) LED d) All of above

ii) Properties of polymer composite depends on : **[1]**
   a) colour of particle b) monomer
   c) size of particle d) none of the above

iii) Which of following industries have prominant applications for quantum dots? **[1]**
   a) Electronic b) Agriculture
   c) Medical d) None

iv) In _______ λ_{max} shift to higher side. **[1]**
   a) hyperchromic effect
   b) hypochromic effect
   c) bathochromic shift
   d) blue shift

P.T.O.

v) Following is the most important characteristic of a good fuel. **[1]**

a) high heat value
b) bright light
c) high sound
d) colourful smoke

vi) Following is not a prominant application of UV spectroscopy. **[1]**

a) Study of reaction kinetics
b) Detection of functional group
c) Quantitative analysis
d) Qualitative analysis

vii) The possible number of fundamental modes of vibrations in case of CO_2 molecule is **[1]**

a) 2
b) 3
c) 4
d) 5

viii) In the process of tinning : **[1]**

a) Zn is coated on Fe
b) Sn is coated on Fe
c) Sn is coated on Zn
d) Fe is coated on Zn

ix) Ideal pilling Bed worth ratio for effective protection of metal against corrosion is **[1]**

a) PBR < 1
b) PBR ≥ 1
c) PBR > 2
d) PBR > 2.5

x) Sacrificial anode is **[1]**

a) anodic protection method
b) cathodic protection method
c) an example of metal cladding
d) an example of powder coating

Q2) a) What are conductive polymer? Give types of conducting polymers. Explain doping with reactions and give any two applications of conducting polymers. **[6]**

b) Give classification and any four applications of SWCNT. **[5]**

c) Give structure, any three properties and any three applications of polycarbonate. **[4]**

OR

Q3) a) Explain with diagram the structure of graphene. Give three properties and three applications of it. **[6]**

b) What is biodegradable polymer? Give three factors affecting biodegradation process of a polymer. Give any two applications of biodegradable polymer. **[5]**

c) What are quantum dots? Give any two types of quantum dots. Write any two applications of Q.D.S. **[4]**

Q4) a) Explain steam reforming of coke and methane with reaction conditions for industrial production of hydrogen. Give process of CO_2 removal. **[6]**

b) Explain fractional distillation process with diagram for petroleum crude. Give composition, boiling temperature range and use of any one fraction. **[5]**

c) Exactly 2.500 gram was weighed into silica crucible. After heating for one hour at 110ºC the residue weighed 2.415 gram. The crucible next was covered with vented lid and strongly heated for exactly seven minutes at 950 $\pm$ 20ºC. The residue weighed 1.528 gram. The crucible was then heated without the cover, until a constant weight was obtained. The last residue was found to weight 0.245 gram. Calculate % moisture, % volatile matter, % ash and % Fixed carbon. **[4]**

OR

Q5) a) Give construction with figure and working of Bomb calorimeter. Write corrected formula to find out Gross calorific value of a coal using Bomb calorimeter. **[6]**

b) What is ‘Power Alcohol’? Give procedure for preparation of ethanol with reactions. Give any two advantages of Power alcohol. **[5]**

c) Observations in the Boy’s Gas calorimeter experiments are given below; find GCV and NCV of fuel. **[4]**

Volume of gas burnt at STP = $0.08m^3$

Mass of cooling water used = 29.5 kg

Rise in temperature of circulatting water = 9.1ºC

Mass of steam condensed = 0.04 kg

Q6) a) Explain with diagram the possible electronic transitions those may occur in organic molecule on absorption of UV-radiations. Also state forbidden electronic transitions. **[6]**

b) Explain conditions for IR radiation absorption by organic molecule. Describe any three applications of IR spectroscopy. **[5]**

c) Give statement and mathematical expression of Lambert-Beer's Law. **[4]**

OR

Q7) a) With the help of diagram explain construction of IR spectrometer. Describe different components of IR spectrometer. **[6]**

b) Give any five applications of UV-visible spectroscopy. **[5]**

c) Explain bending vibrations observed in IR spectroscopy. **[4]**

Q8) a) Explain hydrogen evolution and oxygen absorption mechanisms of wet corrosion with diagram and reactions. **[6]**

b) Explain any five factors responsible for corrosion of metals. **[5]**

c) What is galvanisation? Explain process with diagram. **[4]**

OR

Q9) a) Explain types of oxide films with corrosion reactions for metals, Na, Al, Ag, Mo. **[6]**

b) Explain process of electroplatting with the help of neat labeled diagram. Give any four applications of electroplatting. **[5]**

c) Distinguish between anodic and cathodic coatings. **[4]**

Total No. of Questions : 8]

SEAT No. :

P3921

[Total No. of Pages : 3

[6001]-4004
F.E.
SYSTEMS IN MECHANICAL ENGINEERING (SME)
(2019 Credit Pattern) (Semester - I) (102003)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.***
2) ***Neat Diagram must be drawn wherever necessary.***
3) ***Figures to the right indicates full marks.***

Q1) a) Classify automobiles based on various considerations. **[7]**

b) Define vehicle specification, Explain following engine specifications -**[7]**

i) Torque

ii) Power and

iii) Stroke

c) Compare vehicle specifications for two-wheeler and three-wheeler vehicles. **[4]**

OR

Q2) a) Explain various components of S. I engine with neat sketch. **[7]**

b) Explain hybrid vehicle with neat sketch. Mention its components. **[7]**

c) State difference between electric and hybrid vehicle with examples. **[4]**

Q3) a) Explain the working principle of ABS system in vehicle with neat sketch. State its importance over conventional braking system. **[7]**

b) Explain construction and working of disc brake system with neat sketch. **[7]**

c) Define Gear Ratio for gear box. Determine gear ratio, if a pinion 110 mm with pitch circle diameter meshes with a gear of 450 mm pitch circle diameter. The number of teeth on pinion is 20 and it rotates at 1550 rpm. **[3]**

OR

Q4) a) State types of steering system? Explain Ackerman steering mechanism with neat sketch. **[7]**

b) Explain construction and working of single plate clutch with neat sketch. **[7]**

c) Why safety arrangements needed in vehicle? Explain the importance of seat belts and air bags in the vehicle. **[3]**

Q5) a) State the importance of sheet metal working in manufacturing. Explain Punching and Blanking with neat sketch. **[7]**

b) State significance of Metal Cutting process in industry. Explain following metal cutting processes: **[7]**

i) Turning

ii) Milling and

iii) Drilling operation with neat sketch.

c) Draw a block diagram of 3D printer with all its components. **[4]**

OR

Q6) a) Explain sand casting process with neat sketch. State its advantages and disadvantages. **[7]**

b) With neat sketch explain the shielded metal arc welding. State its applications. **[7]**

c) Write a short note on open and closed die forging. **[4]**

Q7) a) Using block diagrams, write a short note on **[7]**

i) Electric Geyser and

ii) Electric iron State specifications for Electric Geyser. **[7]**

b) Explain with block diagram, working of a refrigerator, state its domestic and industrial applications. **[7]**

c) An electric motor driven pump fills an over headed tank placed at a height of 20 m from the ground level. The mass of the water pumped per second is 5.56 kg. Input power of the motor is 2200 W. Calculate the efficiency of the motor. (Use $g = 9.81\ m/s^2$) **[3]**

OR

Q8) a) Using block diagram, explain the application of blower in kitchen chimney and vacuum cleaner. **[7]**

b) State various applications of springs in domestic appliances. With neat sketch, explain any one mechanism making use of spring. **[7]**

c) A refrigerator has working temperatures in the evaporator and condenser coils as - 30°C and 32°C. What is the maximum COP of the system? Draw its block diagram. **[3]**

Total No. of Questions : 8]

SEAT No. :

P3663

[Total No. of Pages : 4

[6001]-4005

F.E. (All Branches)

BASIC ELECTRICAL ENGINEERING

(2019 Credit Pattern) (Semester - I/II) (103004)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Assume suitable additional data, if necessary.*
5) *Use of non-programable calculator is allowed.*

Q1) a) Define impedance. Draw the impedance triangle for R-L & R-C series circuit. **[4]**

b) Obtain the expression for current and power, when voltage $v = V_m$ sin ωt is applied across purely inductive circuit. **[6]**

c) The series circuit having resistance 10 Ω, inductance 0.1 H and capacitance 150 μF is connected to 1-phase, 200 V, 50 Hz AC supply, Calculate - **[8]**

i) Inductive reactance Xl

ii) Capacitive reactance Xc

iii) Net reactance X

iv) Impedance Z

v) Current drawn by the circuit

vi) Power factor

vii) Active power P

viii) Reactive power Q.

OR

Q2) a) If 200 V, 50 Hz supply is applied across the resistance of 10 Ω, find equation for voltage & current. **[4]**

P.T.O.

b) Derive the expression for power, when voltage $v = Vm \sin \omega t$ is applied across R-L series circuit. **[6]**

c) The series circuit having resistance 10 Ω and capacitance 150 μF draws a current of 9.4 A from 1-phase, 50 Hz AC supply. Calculate -

i) Capacitive reactance

ii) impedance

iii) power factor

iv) supply voltage

v) Active power and

vi) reactive power. **[8]**

Q3) a) Define

i) Balanced load

ii) Unbalanced load and

iii) Phase sequence. **[3]**

b) Derive the EMF equation of single phase transformer. **[6]**

c) Derive the relation between i) phase voltage and line voltage ii) phase current and line current in case of balanced STAR connected 3-ph inductive load. Assume phase sequence RYB. Draw the circuit diagram & necessary phasor diagram. **[8]**

OR

Q4) a) Define the voltage regulation and efficiency of transformer along with formula. **[3]**

b) The maximum flux density in core of a 250/1000 V, 50 Hz, 1-ph transformer is 1.2 T. If EMF/turn is 10 V, calculate i) Primary & secondary number of turns ii) area of cross section of core. **[6]**

c) Three identical impedances each of 6+j8 Ω are connected in star across 3-ph, 400 V, 50 Hz ac supply. Determine. **[8]**

i) phase voltage

ii) phase current and line current

iii) power factor, 3-ph active, reactive and apparent power

Q5) a) State and explain KCL & KVL **[4]**

b) Calculate the current flowing through 4 Ω (AB) for the circuit shown in fig 5b, using Kirchhoff's Laws. All resistances are in Ω **[6]**

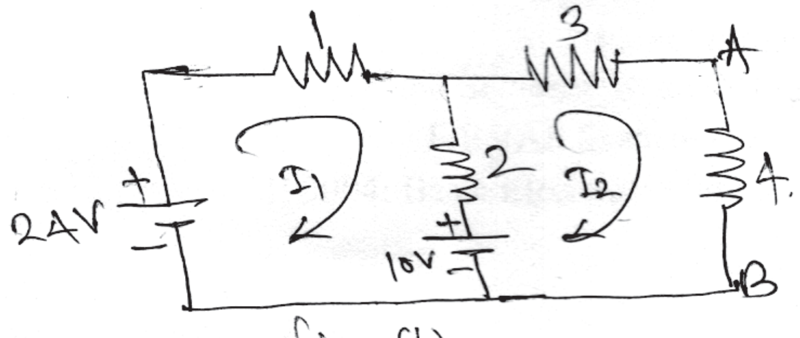


fig 5(b).

c) Derive the equations to convert Delta connected resistive circuit into equivalent Star circuit. **[8]**

OR

Q6) a) Explain the practical current source by means of **[4]**

i) Symbol of representation

ii) Value of internal resistance

iii) Graphs between V and I

b) Calculate the current flowing through 4 Ω (PQ) for the circuit shown in fig 6b, using Superposition Theorem. All resistances are in Ω **[6]**

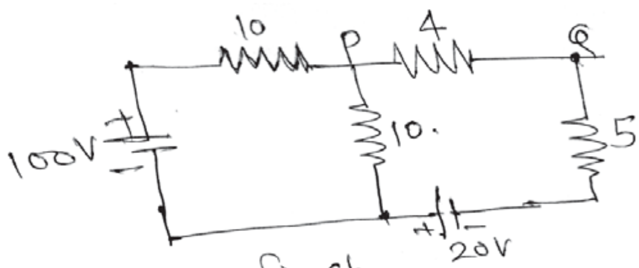


fig.6b.

c) Calculate the current flowing through 4 Ω (PQ) for the circuit shown in fig 6b, using Thevenin's Theorem. **[8]**

Q7) a) Define resistance of the material & state factors on which it depends. **[3]**

b) Explain construction and working principle of Lithium ion battery. **[6]**

c) Derive an expression for insulation resistance of a single core cable with the necessary diagram. **[8]**

OR

Q8) a) State the material used for positive plate, negative plate & electrolyte for lead acid battery. **[3]**

b) The current flowing at the instant of switching 240 V, 40 Watt lamp is 2 A. The TCR of tungsten filament is 0.0055 per degree Celsius at 20ºC. Determine. **[6]**

i) temperature of filament of the lamp ii) working current

c) If α_1 and α_2 are the RTC of a conducting material at t_1^0C and t_2^0C respectively prove that $\alpha_2 = \dfrac{\alpha_1}{1+\alpha_1(t_2 - t_1)}$ & hence, obtain $\alpha_t = \alpha_0 / (1+\alpha_0 . t)$ **[8]**

Total No. of Questions : 8]

SEAT No. :

P3922

[Total No. of Pages : 2

[6001]-4006
F.E.
BASIC ELECTRONICS ENGINEERING
(2019 Pattern) (Semester - II) (104010)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) i) Convert:

1) (372.26)8 to Hexadecimal
2) $(5F1.6C)_{16}$ to Octal
3) $(9D.33)_{16}$ to Decimal

ii) Solve:

1) (110011-111001) using 2s compliment method
2) (1101×110)
3) (111011.11+100100.01

[6]

b) Define Universal Logic Gates. Why they known as Universal Logic Gates? **[6]**

c) Draw block diagram of Microprocessor and explain function of each block. **[6]**

OR

Q2) a) With the help of truth table, explain operation of AND, OR, EX-OR gates. **[6]**

b) State and prove De-Morgan's Theorems. **[6]**

c) Explain in detail the working of a full adder with the help of a truth table and give its sum and carry. **[6]**

P.T.O.

Q3) a) Explain digital multimeter with block diagram. **[6]**

b) Explain Power Scope with block diagram. **[5]**

c) Explain how to convert Galvanometer to Analog Voltmeter and how to use it as multi-range Voltmeter? **[6]**

OR

Q4) a) Explain function Generator with block diagram. **[6]**

b) Explain Auto Transformer and list its applications. **[5]**

c) Explain how to convert Galvanometer to Analog Ammeter and how to use it as multi-range Ammeter? **[6]**

Q5) a) Explain selection criteria of transducers. **[6]**

b) Draw construction of LVDT and explain its operation. Write its advantages, disadvantages and applications. **[6]**

c) Explain working principle of strain gauge. Explain load cell. **[5]**

OR

Q6) a) Differentiate between active and passive sensors. **[6]**

b) Explain RTD with its construction, working, advantages, disadvantages and applications. **[6]**

c) Explain operation of Biosensor with one application. **[5]**

Q7) a) With the help of block diagram, explain basic communication system. **[6]**

b) Explain IEEE electromagnetic frequency spectrum and state allotment of frequency bands for different applications. **[6]**

c) Draw diagram explain GSM architecture. **[6]**

OR

Q8) a) Explain different types of cables used in electronic communication. **[6]**

b) Draw block diagram of FM Transmitter and explain. **[6]**

c) Explain cellular communication system. **[6]**

Total No. of Questions : 8]

SEAT No. :

P3923

[Total No. of Pages : 7

[6001]-4007
F.E. (Common)
ENGINEERING MECHANICS
(2019 Pattern) (Semester - I/II) (Credit System) (101011)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary and clearly state.***
5) ***Use of cell phone is prohibited in the examination hall.***
6) ***Use of electronic pocket calculator is allowed.***

Q1) a) Determine the force 'P' need to pull over the 50 kg smooth roller over the step of 50 mm as shown in Fig. 1 a. Calculate the contact reactions at B if radius of roller is 300 mm. Take θ=30°. **[6]**

b) The square plate has mass of 1800kg with mass center at 'G'. Calculate the tension in each of the three cables with which the plate is lifted while remaining horizontal as shown in Fig. 1 b. **[8]**

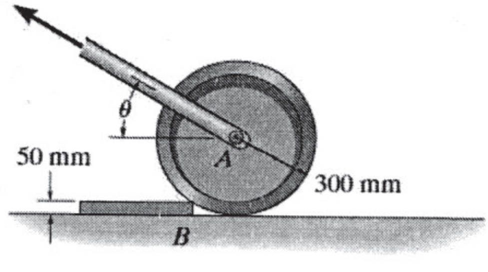


Fig. 1 a

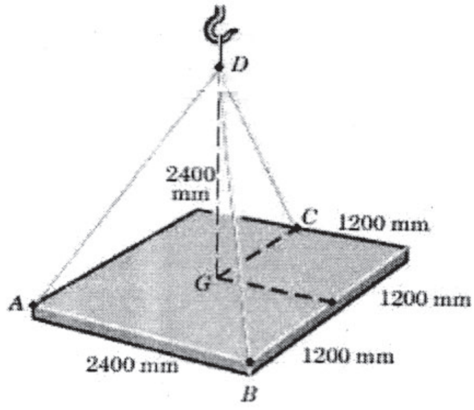


Fig. 1 b

P.T.O.

c) Explain Simple, Roller, Hinge and Fixed support with number of reactions developed at each support with sketch. **[4]**

OR

Q2) a) Determine the support reactions at fixed end A for a beam loaded with 6 kN/m UVL and 3 kN/m UDL as shown in Fig. 2 a. Neglect the weight of 3 m span beam. **[6]**

b) A uniform steel plate of 20 cm × 20 cm weighing 750 N is suspended in horizontal plane by three vertical wireas as shown in Fig. 2 b. Calculate the tension in each wire at A, B and C. **[6]**

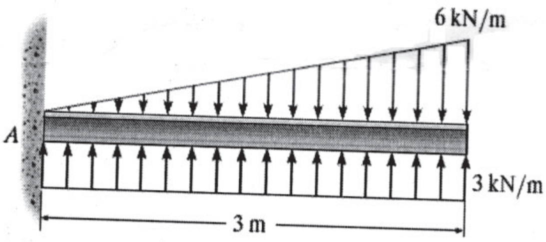


Fig. 2 a

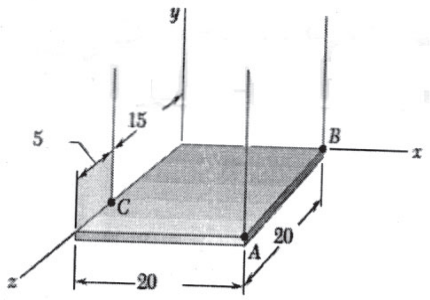


Fig. 2 b

c) Explain how uniformly distributed load (UDL) and uniformly varying load (UVL) is converted in to a point load with sketch. **[6]**

Q3) a) Determine the force in all members of the truss loaded with 3 kN and 4 kN forces at D and B respectively with supports hinge at A and Roller at B, as shown in Fig. 3 a. Take $\theta = 30^{\circ}$. **[6]**

b) Determine the x and y components of forces acting at joint B and D on the member BD for a frame loaded and supported as shown in Fig. 3 b. **[7]**

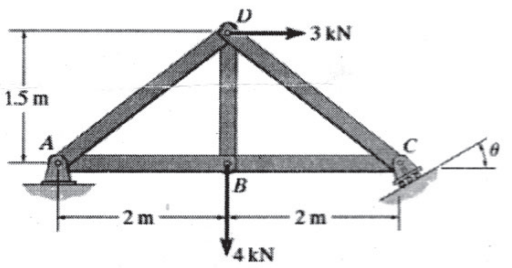


Fig. 3 a

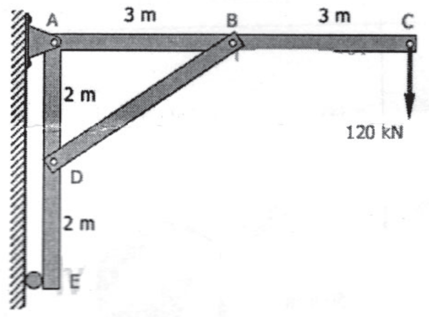


Fig. 3 b

c) Define zero force members in truss and what are the conditions to identify them, with a sketch? **[4]**

OR

Q4) a) Determine the forces in the members AD, BD and BC for the truss loaded and supported as shown in Fig. 3a. **[6]**

b) Knowing that lamp attached at D is, $m_F = 20$ kg, determine the tension in each segment of the cable loaded and supported as shown in Fig. 4b.**[5]**

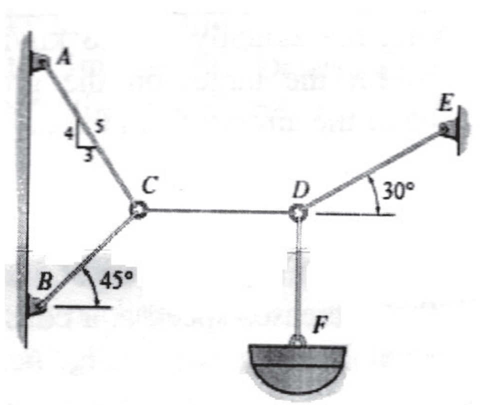


Fig. 4 b

c) Explain 2.j –3 <m; 2.j – 3 = m; 2.j –3 > m with sketch. **[6]**

Q5) a) The motion of a particle is given by : $a = t^3 - 3t^2 + 5$ where 'a' is the acceleration in m/s^2 and 't' is the time in seconds. The velocity of the particle, at t = 1 second is 6.25 m/sec and the displacement is 8.8 m. Calculate the displacement and velocity at t = 2 seconds. **[6]**

b) A ball thrown vertically upward with a velocity of 10 m/s from a window located 20 m above the ground. Knowing that the acceleration of the ball is cosntant and equal to 9.81 m/s^2 downward, determine **[6]**

i) the highest elevation reached by the ball and the corresponding value of t;

ii) velocity with which it hit the ground.

c) A golf player hits the ball from point A with a velocity 45 m/s as shown in Fig. 5c at an angle of 20° with horizontal. Determine the maximum height it reaches and the horizontal distance it falls w.r. to A. Consider ground to be horizontal. **[6]**

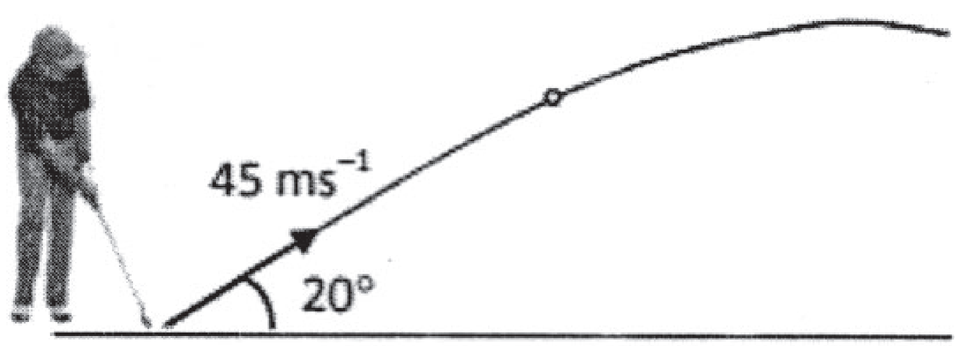


Fig. 5c

OR

Q6) a) The acceleration of a particle is given by an expression, $a = k.t^2$. At t=0, velocity of the particle is – 12 m/s. Knowing that v = 0 and x = 15 m when t = 4 s, write the equation of motion of a particle. **[6]**

b) An aircraft, moving horizontally at 108 km/hr at an altitude of 1000 m wants to hit the target on the ground. Estimate the horizontal distance of the aircraft from the target, when it released the bomb. Calculate also the direction and velocity with which the bomb hits the target. Neglect air friction. **[6]**

c) A motorist starts from rest at point A on a circular ramp of 150 m radius when t = 0 s, increases speed at a constant rate and enters the highway at point B as shown in **Fig. 6c**. Knowing that her speed increases with same rate till it reaches to 100 km/h at point C, determine the speed at point B. **[6]**

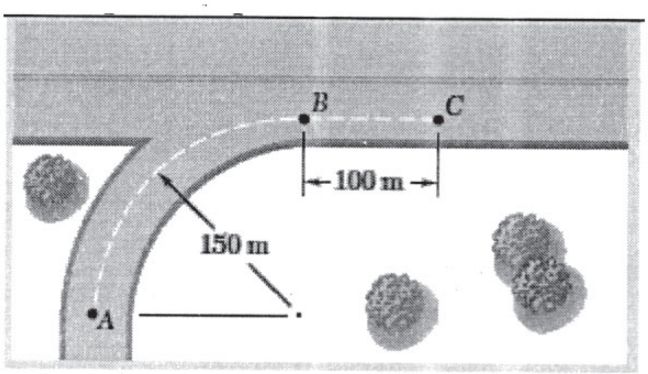


Fig. 6 c

Q7) a) If the coefficient of kinetic friction between the 50-kg crate and the ground is $\mu_k = 0.3,$ determine the distance the crate travels when its velocity reaches to 8 m/s. Assume crate starts from rest, and P = 200 N, for crate shown in Fig. 7a. Use work-Energy principle. **[6]**

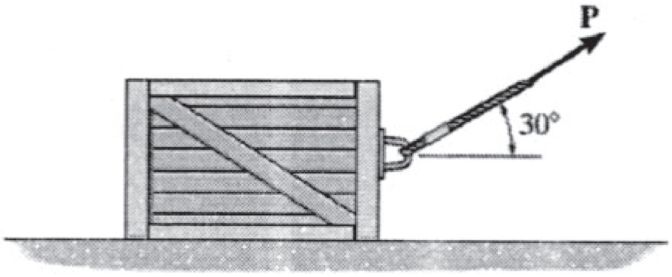


Fig. 7 a

b) A racing car travels around the horizontal circular track of radius 100m. If the car starts from rest and accelerates with tangential acceleration of 7 m/s^2 for some time. Determine the time and velocity when the total acceleration of the racing car reaches to 8 m/s^2. **[6]**

c) A ball of mass 1 kg dropped from 5m height on a horizontal floor rebounds back to 3m height. Determine the coefficient of restitution between the floor and ball. Also Determine its renounce height after falling from 3m again. **[5]**

OR

Q8) a) The conveyor belt is designed to transport packages of various weights. Each 10-kg package has a coefficient of kinetic friction $\mu_k = 0.15$. If the speed of the conveyor is 5 m/s, and then it suddenly stops, determine the distance the package will slide on the belt before coming to rest. **[6]**

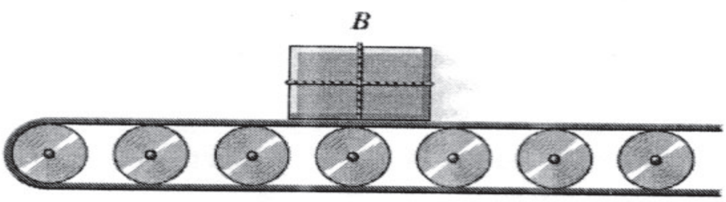


Fig. 8 a

b) Cylinder A of 0.5 kg is dropped from 2.4 m onto pan B of 2.5 kg, which is at a resting on a spring constant k = 3kN/m. Assuming the impact to be perfectly plastic, determine the compression of the spring after impact. **[6]**

c) Ball 'A' of 5 kg moving with 10m/s rightwards, strikes with ball 'B' of 1 kg which is at rest. If after the impact the velocity of the ball 'B' is 10 m/s rightwards. Determine, the velocity of the ball 'A' after impact. Also determine coefficient of restitution 'e'. **[5]**

Total No. of Questions : 8]

SEAT No. :

P-3664

[Total No. of Pages : 3

[6001]-4008
F.E. (Semester - II)
PROGRAMMING AND PROBLEM SOLVING
(2019 Pattern) (110005)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates :

1) ***Question one is compulsory.***
2) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.***
3) ***Neat diagrams must be wherever necessary.***
4) ***Assume suitable data wherever necessary.***

Q1) a) Explain in-built and user defined functions with syntax and suitable example. **[6]**

b) Explain the following terms with suitable examples. **[6]**

i) local variable

ii) global variable

c) Write a program to check whether a number is prime or not using function. **[5]**

OR

Q2) a) Explain the following types of function arguments with examples: **[6]**

i) positional arguments

ii) variable length arguments

b) Explain different ways of importing an in-built module in python with suitable example. **[6]**

c) Write a program to find cube of a number using lambda function. **[5]**

Q3) a) Justify strings are immutable with example. **[6]**

b) Explain the following with suitable example. **[6]**

i) ord() and chr() function

ii) in and not in operators on string

c) What is the output of the following statement for the given string? **[5]**

S = "Programming and Problem Solving"

i) print(S[:11])

ii) print(S[::-1])

iii) print("And" not in S)

iv) print(S[4])

v) print (S[0:10])

OR

Q4) a) Explain string format operator with suitable example. **[6]**

b) Explain following string methods with example. **[6]**

i) title()

ii) startswith()

iii) zfill()

c) Write a program to display a string and count characters in the string using a loop. **[5]**

Q5) a) Explain the following Programming Paradigms in detail. **[6]**

i) Monolithic Programming

ii) Structured Programming

iii) Object Oriented Programming

b) Explain the following concepts with example. **[6]**

i) public members

ii) private members

c) Write a python program to create a class Student with the attributes Name, roll no and age and display data of 4 students. **[6]**

OR

Q6) a) Explain any three object oriented features in brief. **[6]**

b) Explain class method and class variable with suitable example. **[6]**

c) Write a program to calculate area of triangle using a class. **[6]**

Q7) a) What is a file? Explain relative and absolute path of a file. **[6]**

b) Explain the following file handling methods. **[6]**

i) write()

ii) writelines()

ii) close()

c) Explain file access modes in brief. **[6]**

OR

Q8) a) Explain different directory methods with example. **[6]**

b) Differentiate between text and binary files. **[6]**

c) Explain the following dictionary methods. **[6]**

i) update()

ii) keys()

iii) pop()

▽ ▽ ▽ ▽

Total No. of Questions : 9]

SEAT No. :

P3924

[Total No. of Pages : 4

[6001]-4009

F.E.

ENGINEERING MATHEMATICS-II

(2019 Pattern) (Semester - I/II) (107008)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Q. No.1 is compulsory.*
2) *Solve Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.*
3) *Neat diagrams must be drawn wherver necessary.*
4) *Figures to the right indicate full marks.*
5) *Use of electronic pocket calculator is allowed.*
6) *Assume suitable data, if necessary.*

Q1) Write the correct option for the following multiple choice questions

a) $\int_0^{\pi/2} \sin^4 + dt =$ **[2]**

i) $\frac{3\pi}{16}$ ii) $\frac{3}{8}$

iii) $\frac{3}{16}$ iv) $\frac{3\pi}{8}$

b) The equation of the tangent to the curve $y(1+x^2)=x$ at origin, if exist is **[2]**

i) X=0 ii) Y=0

iii) $x=1, x=-1$ iv) $y=x$

c) The value of double integration $\int_0^1\int_0^1 \frac{1}{1+x^2}\cdot\frac{1}{1+y^2}\,dxdy =$ **[2]**

i) $\frac{\pi}{2}$ ii) $\frac{\pi^2}{2}$

iii) $\frac{\pi}{4}$ iv) $\frac{\pi^2}{8}$

P.T.O.

d) Centre (C) of sphere $x^2 + y^2 + z^2 - 2z = 4$ is **[2]**

i) $C \equiv (0,0,0)$ ii) $C \equiv (0,0,1)$

iii) $C \equiv (0,1,0)$ iv) $C \equiv (1,0,0)$

e) The curve $r = 2a\sin\theta$ is symmetrical about **[1]**

i) Pole ii) $\theta = 0$

iii) $\theta = \dfrac{\pi}{2}$ iv) $\theta = \dfrac{\pi}{4}$

f) $\iiint_V dxdydz$ represents **[1]**

i) Area ii) Mass

iii) Mean Value iv) Volume

Q2) a) If $I_n = \int_0^{\frac{\pi}{4}} sec^n\theta\, d\theta$, then prove that $I_n = \dfrac{\left(\sqrt{2}\right)^{n-2}}{n-1} + \dfrac{n-2}{n-1} I_{n-2}$ **[5]**

b) Evaluate $\int_2^5 (x-2)^3 (5-x)^2 dx$ **[5]**

c) Using DUIS, prove that $\int_0^\infty \dfrac{e^{-x} - e^{-ax}}{x\sec x} dx = \dfrac{1}{2}\log\left(\dfrac{a^2+1}{2}\right), a > 0$ **[5]**

OR

Q3) a) Evaluate

i) $\int_0^{2\pi} \sin^2\dfrac{\theta}{2}\cos^{10}\dfrac{\theta}{2}\, d\theta$ **[3]**

ii) $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \cos^4 t\ dt$ **[2]**

b) Evaluate : $\int_0^1 (x\log x)^4 dx$ **[5]**

c) Prove that: $\frac{1}{x}\frac{d}{da}erf_c(ax) = -\frac{1}{a}\ \frac{d}{dx}erf(ax)$ **[5]**

Q4) a) Trace the curve $x^2y^2 = a^2(y^2 - x^2)$. **[5]**

b) Trace the curve $r = a\,(1+\cos\theta)$. **[5]**

c) Find the are length of Astroid $x^{2/3} + y^{2/3} = a^{2/3}$ **[5]**

OR

Q5) a) Trace the curve $x^3 + y^3 = 3axy$. **[5]**

b) Trace the curve $r = a\cos 2\theta$ **[5]**

c) Trace the curve $x = a\,(t+\sin t),\ y = a\,(1+\cos t)$. **[5]**

Q6) a) Show that the plane $x-2y-2z=7$ touches the sphere $x^2 + y^2 + z^2 - 10y - 10z - 31 = 0$. Also find the point of contact. **[5]**

b) Find the equation of right circular cone whose vertex is at origin, whose axis is the line $\frac{x}{1} = \frac{y}{2} = \frac{8}{3}$ and which has a semi-vertical angle of 60°. **[5]**

c) Find the equation of right circular cylinder of radius 3 and axis is the line $\frac{x-1}{2} = \frac{y-2}{1} = \frac{z-3}{2}$. **[5]**

OR

Q7) a) Show that the two spheres: $x^2 + y^2 + z^2 = 25$ and $x^2 + y^2 + z^2 - 18x - 24y - 40z + 225 = 0$ touches externally. Also find the point of contact. **[5]**

b) Find the equation of right circular cone whose vertex is at (0,0,10), axis is the Z-axis and the semi-vertical angle is $\cos^{-1}\left(\frac{2}{\sqrt{5}}\right)$ **[5]**

c) Find the equation of right circular cylinder of radius $\sqrt{6}$, whose axis passes through the origin and has direction cosines $\frac{1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$. **[5]**

Q8) a) Evaluate $\iint_R xy\, dx\, dy$, where R is $x^2 = y, y^2 = -x$. **[5]**

b) Find area of cardioide $r = a(1 - \cos\theta)$ using double integration. **[5]**

c) Find the moment of inertia of one loop of the lemniscate $r^2 = a^2 \cos 2\theta$ about initial line. Givenl that density $\rho = \frac{2m}{a^2}$, m is a mass of the area. **[5]**

OR

Q9) a) Change order of integration $\int_0^5 \int_{2-x}^{2+x} f(x, y)\, dx dy$. **[5]**

b) Find the volume bounded by the cone $x^2 + y^2 = z^2$ and paraboloid $x^2 + y^2 = z$. **[5]**

c) Find the x - co-ordinate of centre of gravity of one loop of $r = a\cos 2\theta$, which is in the first quadrant, given that area of loop is $\mathrm{A} = \frac{\pi a^2}{8}$. **[5]**

Total No. of Questions : 8]

SEAT No. :

P3925

[Total No. of Pages : 3

[6001]-4010

F.E.
ENGINEERING GRAPHICS
(2019 Pattern) (Semester - I/II) (102012)

Time :2½ Hours] *[Max. Marks : 50*

Instructions to the candidates:

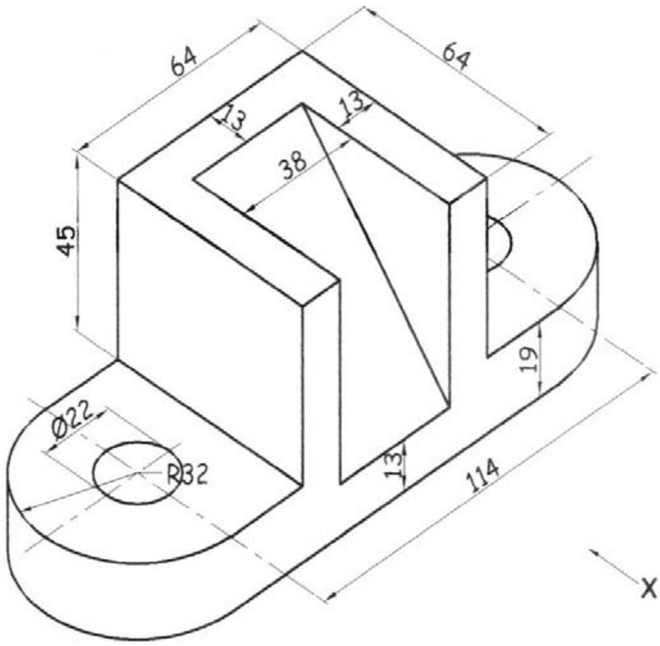
1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Assume suitable data, if necessary.***
3) ***Retain all the construction lines.***

Q1) Draw an ellipse by rectangular method if the major axis and minor axis are 160 mm and 100 mm respectively. **[8]**

OR

Q2) Draw a cycloid of a rolling circle of diameter 40 mm. Assume the point 'P' is away from the base. **[8]**

Q3) Figures shows a pictorial view of an ojbect. By using first angle method of projection draw, Front View in the direction of X, Top View and Left-Hand Side View. Give dimensions in all views. **[16]**



OR

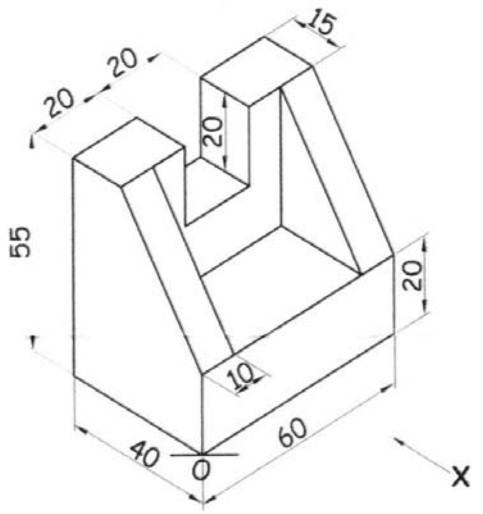
P.T.O.

Q4) Figure shows the pictorial view of an object. By first angle method of projection draw: **[16]**

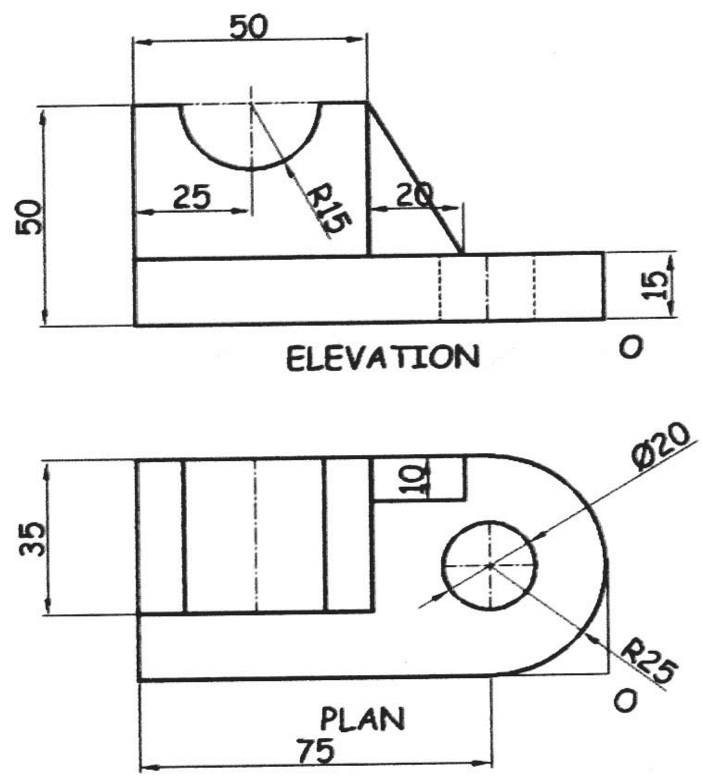
a) Front View in the X direction

b) Top View

c) Sectional Left-Hand Side View along symmetry of the object.

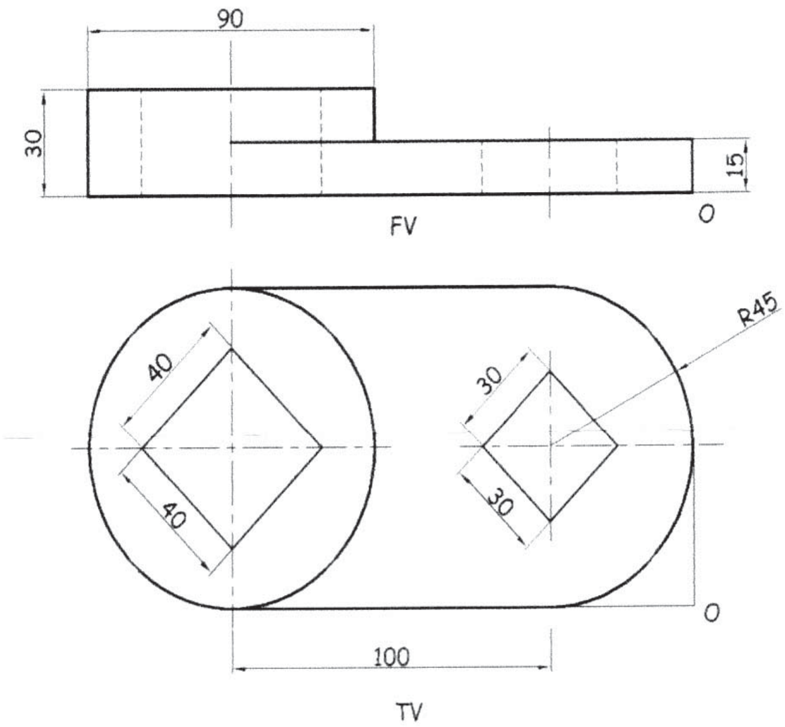


Q5) Figure show orthographic views of an object by first angle method of projection. Draw its isometric view and give all the dimensions. **[16]**



OR

Q6) Figure show orthographic views of an object by first angle method of projection. Draw its isometric view and give all the dimensions. **[16]**



Q7) A hexagonal pyramid of base 30 mm and axis and axis height 75 mm is resting on H.P. with side of the base parallel to V.P. It is cut by a section plane, perpendicular to V.P. and inclined at 45º to H.P. and bisecting axis of the pyramid. Draw the development of lateral surfaces of the pyramid. **[10]**

OR

Q8) A pentagonal prism side of base 30 mm and axis 60 mm long is kept on HP in such a way that one of its base edges is parallel to the VP and near to the observer. A cutting plane bisects its axis at 45º. Draw the development of lateral surfaces the pentagonal prism. **[10]**

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Total No. of Questions : 8]

SEAT No. :

P4230

[Total No. of Pages : 4

[6001]-5001

F.E.

ENGINEERING MATHEMATICS - I

(2015 Pattern) (Credit System) (Semester - I & II) (107001)

Time : 2 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.***
2) ***Figures to the right indicate full marks.***
3) ***Use of electronic pocket calculator allowed.***
4) ***Assume suitable data, if necessary.***

Q1) a) Examine consistency of following system. **[4]**

$x+y+z = 1$

$x+2y+4z = 2$

$x+4y+10z = 4$

b) Find eigenvalues and eigenvector corresponding to largest eigenvalue of **[4]**

$$A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$$

c) If $\sin(\alpha + i\beta) = x + iy$ then prove that **[4]**

i) $\dfrac{x^2}{\cosh^2\beta} + \dfrac{y^2}{\sinh^2\beta} = 1$

ii) $\dfrac{x^2}{\sin^2\alpha} - \dfrac{y^2}{\cos^2\alpha} = 1$

OR

Q2) a) Find roots of $x^5+1 = 0$. **[4]**

b) Find principal value of i^{-2i} **[4]**

c) Show that **[4]**

$$A = \frac{1}{3}\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix} \text{ is orthogonal}$$

Q3) a) Solve any one: **[4]**

i) Test the convergence of the series: $\sum \frac{2^n}{n^3+1}$

ii) Test the convergence of the series: $1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+\frac{1}{5}$.........

b) Prove that :

$x \text{ cosec } x = 1+\frac{x^2}{6}+\frac{7}{360}x^4+$........... **[4]**

c) Find n^{th} derivative of

$y = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$ **[4]**

OR

Q4) a) Solve any one : **[4]**

i) $\lim\limits_{x\to 0}\frac{x-\log(1+x)}{x^2}$

ii) $\lim\limits_{x\to 0}(\cos x)^{\cot x}$

b) Using Taylor's theorem expand x^3-2x^2+3x+1 in powers of x–1. **[4]**

c) Find y_n for $y = x^2 e^{ax}$ by using Leibnitz's theorem. **[4]**

Q5) Solve any two :

a) If $u = 2x + 3y, \quad v = 3x - 2y$ **[6]**

Prove that

i) $\left(\frac{\partial y}{\partial v}\right)_x \left(\frac{\partial v}{dy}\right)_u = \frac{13}{4}$

ii) $\left(\frac{\partial u}{\partial x}\right)_y \left(\frac{\partial x}{\partial u}\right)_v = \frac{4}{13}$

b) If $u = \frac{x^3 + y^3}{x + y}$ then by Euler's theorem and deductions prove **[7]**

i) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = zu$

ii) $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = 2u$

c) If $u = f(r,s)$ and $r = x^2 + y^2$ and $s = x^2 - y^2$ then prove that **[6]**

$$y\frac{\partial u}{\partial x} + x\frac{\partial u}{\partial y} = 4xy\frac{\partial u}{\partial r}$$

OR

Q6) Solve any two : **[6]**

a) If $z = e^{y+ax} + (y - ax)^z$, find the value of $\frac{\partial^2 z}{\partial x^2} - a^2\frac{\partial^2 z}{\partial y^2}$

b) If $u = \sin^{-1}\left(x^2 + y^2\right)^{1/5}$ then prove that **[7]**

$$x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = \frac{2}{5}\tan u\left[\frac{2}{5}\sec^2 u - 1\right]$$

c) If $z = f(x,y)$ where $x = u + v, \quad y = uv$ then prove that

$$u\frac{\partial z}{\partial u} + v\frac{\partial z}{\partial v} = x\frac{\partial z}{\partial x} + 2y\frac{\partial z}{\partial y}.$$ **[6]**

Q7) a) If $x = r\cos\theta,\ y = r\sin\theta$,

then show that $J\ J' = 1$. **[4]**

b) Examine whether the following functions are functionally dependent. If so, find the relation between them.

$u = \sin^{-1}x + \sin^{-1}y,\ v = x\sqrt{1-y^2} + y\ \sqrt{1-x^2}$. **[4]**

c) Discuss the maxima and minima of the function $x^2 + y^2 + 6x + 12$. **[5]**

OR

Q8) a) If $u = x + y$ and $v = x^2 + y^2$, **[4]**

find $\dfrac{\partial u}{\partial x}$.

b) Find the percentage error in the area of an ellipse when errors of 2% and 3% are made in measuring its major and minor axes respectively. **[4]**

c) Divide 120 into three parts so that the sum of their products taken two at a time shall be maximum. **[5]**

Total No. of Questions : 8]

SEAT No. :

P-4231

[Total No. of Pages : 2

[6001]-5002

F.E. (Semester - I/II)

ENGINEERING CHEMISTRY

(2015 Pattern) (107009) (Credit System)

Time : 2 Hours] ***[Max. Marks : 50***

Instructions to the candidates :

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right indicate full marks.***
3) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
4) ***Assume suitable data, if necessary.***

Q1) a) Describe Demineralisation method with figure, process, ion exchange and regeneration reaction for softening of hard water. **[6]**

b) What is a reference electrode? Draw a neat labeled diagram of glass electrode and give its representation. **[3]**

c) Define the terms : **[3]**

i) Resistance ii) Cell constant

iii) Equivalent conductance

OR

Q2) a) Explain principle, instrumentation and applications of UV visible spectrophotometer. **[6]**

b) Explain any three principles of green chemistry. **[3]**

c) An exhausted zeolite softener was regenerated by passing 150lit. of NaCl solution having strength 150gm/lit. of NaCl how many lit of hard water sample having hardness 400ppm can be softened by using softner. **[3]**

Q3) a) Give preparation reaction properties and applications of following. **[6]**

i) Styrene - butadiene rubber,

ii) HDPE

b) What is power alcohol? Give preparation reaction and advantages of power alcohol. **[3]**

P.T.O.

c) Calculate carbon and hydrogen in coal sample from the following data: 0.25gm of coal sample on burning in combustion chamber in current of pure O_2, was found to increase weight of $CaCl_2$ U tube by 0.12gm and KOH U tube by 0.57 gm. **[3]**

OR

Q4) a) Draw neat labeled diagram and give the construction working of Bomb calorimeter to determine GCV of a fuel. State formula with corrections to calculate GCV. **[6]**

b) Explain bulk polymerization technique Draw the figure and state its disadvantages. **[3]**

c) Distinguish between thermo-softening and thermosetting polymer with examples. **[3]**

Q5) a) Explain industrial production of hydrogen by steam reforming of methane and coke. **[5]**

b) Give structure, one method of preparation of silane. **[4]**

c) Explain the structure and properties of graphite. **[4]**

OR

Q6) a) What are carbon nanotubes? Give types with respect to their structure and its applications. **[5]**

b) Discuss the properties of hydrogen which make it difficult for storage. **[4]**

c) Explain the structure of diamond Give its properties and applications. **[4]**

Q7) a) Discuss any five factors affecting corrosion. **[5]**

b) What is cathodic protection? Explain any one method in detail. **[4]**

c) Define electroplating. Explain the process with a neat labeled diagram and its applications. **[4]**

OR

Q8) a) Define Wet corrosion. Explain corrosion by hydrogen evolution mechanism. **[5]**

b) What is anodic and cathodic coating? Which one is more protective? Give reason. **[4]**

c) What is Galvanization? Explain the process with neat labeled diagram to protect iron from corrosion. **[4]**

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Total No. of Questions : 8]

SEAT No. :

P4232

[Total No. of Pages : 2

[6001]-5003

F.E.

ENGINEERING PHYSICS

(2015 Credit Pattern) (Semester - I & II) (107002)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of non-programmable electronic pocket calculator is allowed.*
5) *Assume suitable data, if necessary.*

Constants:

1) *Mass of electron = 9.1×10^{-31} kg*
2) *Charge on electron = e = 1.6×10^{-19} C*
3) *Plank's Constant = h = 6.63×10^{-34} J.s*

Q1) a) For a thin film of uniform thickness, derive the conditions for constructive and destructive interference for the light rays that are reflected from the top surface of the film. **[6]**

b) Explain in brief Magnetostriction Effect. **[3]**

c) In a Newtons rings experiment, the diameter of certain right ring is 0.65 cm and that of 10th bright ring beyond it is 0.95 cm. If $\lambda = 6000\ \mathring{A}$ calculate the radius of curvature of a convex lens in contact with the glass plate.**[3]**

OR

Q2) a) Explain in brief Piezoelectric effect. Explain construction and working of piezoelectric oscillator for the production of ultrasonic waves. **[6]**

b) What is diffraction of light? Explain the difference between Fraunhofer and Fresnel diffraction (any two points). **[3]**

c) Calculate the depth of the sea if the time interval between the emitted signal and the echo received is 2sec in sonar studies. Assume the velocity of sound in sea water as 1490m/s. **[3]**

Q3) a) Explain construction and working of Ruby laser. Why it is pulsed laser? **[6]**

b) Draw the energy band diagram for p-n junction diode in **[3]**

i) zero bias condition ii) forward bias condition

c) For a light of wavelength 6350 AU, find the thickness for a Half Wave Plate and Quarter Wave Plate. (Given: μ_o =1.658 and μ_e = 1.486). **[3]**

OR

Q4) a) What is Hall effect? Derive an expression for Hall Voltage and Hall Coefficient. State applications of Hall effect. **[6]**

b) Explain double refraction in brief with suitable diagram? State points of differences between positive and negative crystal (any two). **[3]**

c) Calculate the conductivity of pure Si at room temperature when the concentration of carriers is 1.6×10^{10} per cm^3. (Given μ_e =1500 cm^2/V.sec and μ_h =500 cm^2/V.sec). **[3]**

Q5) a) Starting from de-Broglie equation, derive Schrodinger's time independent wave equation. **[6]**

b) What is phase velocity? Show that the phase velocity of a matter wave is C^2/v. **[4]**

c) An electron is trapped in a rigid box of 2.5 AU wide. Find the 3rd energy level of electron in eV. **[3]**

OR

Q6) a) State and explain Heisenberg's Uncertainty Principle. Illustrate it by the experiment of electron diffraction at a single slit. **[6]**

b) Explain physical significance of ψ and $|\psi|^2$. State and explain the mathematical conditions that wave function ψ need to obey. **[4]**

c) Find the de-Broglie wavelength of electron of energy 10 keV. **[3]**

Q7) a) What is superconductivity? Distinguish between Type I & Type II superconductors (any four points). **[6]**

b) Explain any one physical method for synthesis of nanoparticles. **[4]**

c) List the three applications of nano-particles. Explain any one of them in brief. **[3]**

OR

Q8) a) Explain Optical and Electrical properties of nano-particles. **[6]**

b) What is Meissner effect? Explain in brief why superconductors exhibit Meissner effect. **[4]**

c) List the three applications of superconductors. Explain any one of them in brief. **[3]**

Total No. of Questions : 8]

SEAT No. :

P-4233

[Total No. of Pages : 2

[6001]-5004

F.E.

BASIC ELECTRONICS ENGINEERING

(2015 Pattern) (Semester - I & II) (104012)

Time : 2 Hours] ***[Max. Marks : 50***

Instructions to the candidates :

1) ***Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7or Q.No.8.***
2) ***Figures to the right indicate full marks.***

Q1) a) Explain half wave rectifier circuit with it's waveforms. **[6]**

b) Draw and explain BJT as a switch along with its region of operations. **[6]**

OR

Q2) a) Explain Zener diode as voltage regulator. **[6]**

b) Draw and explain drain and transfer characteristics of n-channel enhancement MOSFET. **[6]**

Q3) a) With a neat circuit diagram explain Inverting summing amplifier with its equation. **[6]**

b) Compare Microprocessor and micro-controller. **[6]**

OR

Q4) a) Draw and explain diagram of IC555 as an Astable multivibrator along with its waveform. **[6]**

b) Implement Basic Logic gates using any one of universal gates. **[6]**

Q5) a) Draw the symbol and explain operation of TRIAC along with it's VI characteristics. **[7]**

b) Compare RTD, Thermister and Thermocouple. **[6]**

OR

Q6) a) Draw and explain Linear Variable Differential Transducer (LVDT) along with its transfer characteristics. **[7]**

b) Draw and explain digital thermometer. **[6]**

Q7) a) What is the need of Modulation? Explain modulation index for AM and FM techniques. **[7]**

b) Compare various cables used in communication system. **[6]**

OR

Q8) a) A carrier of 20V peak and frequency 1 MHz is amplitude modulated (AM) by a sine wave of 10V peak and frequency 1 kHz. Determine the modulation index for the modulated wave and draw the frequency spectrum for AM wave. **[7]**

b) Draw and explain GSM architecture. **[6]**

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Total No. of Questions : 8]

SEAT No. :

P-4234

[Total No. of Pages : 3

[6001]-5005

F.E. (All Branches)

BASIC ELECTRICAL ENGINEERING

(2015 Pattern) (103004) (Semester - I & II)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates :

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat Diagrams must be drawn wherever necessary.***
3) ***Figure to right indicate full marks.***
4) ***Use of Non-Programmable Scientific Calculators is allowed.***
5) ***Assume Suitable Data if necessary.***

Q1) a) Obtain the expression for insulation resistance of the single core cable. Draw the necessary diagram. **[6]**

b) Obtain the expression for coefficient of coupling between two magnetically coupled coils. **[6]**

OR

Q2) a) Compare Electrical & Magnetic circuit (similar points only). **[6]**

b) If the temperature coefficient of resistance for copper wire is 0.00426 per degree Celsius at 0 °C. Find the temperature coefficient of resistance at **[6]**

i) 20 °C and

ii) 50 °C &

iii) 70 °C

Q3) a) Obtain the emf equation of 1-phase transformer. **[6]**

b) Obtain the expression for RMS value of alternating current in terms of its peak value. **[7]**

OR

P.T.O.

Q4) a) Convert rectangular to polar OR polar to rectangular form **[6]**

i) $Z = 3 - j4$

ii) $Z = 5 + j\,10$

iii) $Z = 5 < -36.87^{o}$

b) The alternating voltage expression is given by $v = 282.84 \sin(100\,\pi t)$ Volt. Determine :

i) maximum value of voltage

ii) RMS value of voltage

iii) average value of voltage

iv) frequency

v) periodic time

vi) power consumed when it connected to resistance of 10 Ω. **[7]**

Q5) a) Obtain the expression for power, when voltage $v = V_m \sin \omega t$ is applied across R-L series circuit. Draw the circuit diagram and phasor diagram.**[6]**

b) State the relation between

i) phase voltage and line voltage

ii) phase current and line current incase of balanced star connected 3-ph inductive load. By the use of above relations, derive the expressions for 3-ph active power and 3-ph reactive power. **[6]**

OR

Q6) a) Define admittance, conductance & suscepatnce. State their units. **[6]**

b) The R-L series circuit having resistance 10 Ω and inductance 0.1 H is connected to 1-phase, 200 V, 50 Hz AC supply. Calculate -

i) inductive reactance X_L

ii) impedance

iii) current drawn by the circuit

iv) power factor

v) Active power and

vi) reactive power. **[6]**

Q7) a) Derive the equations to convert Delta connected resistive circuit into equivalent star circuit. **[6]**

b) Write down the steps to find current through resistance R_3 using Superposition theorem for the circuit shown in fig. 7.b. **[7]**

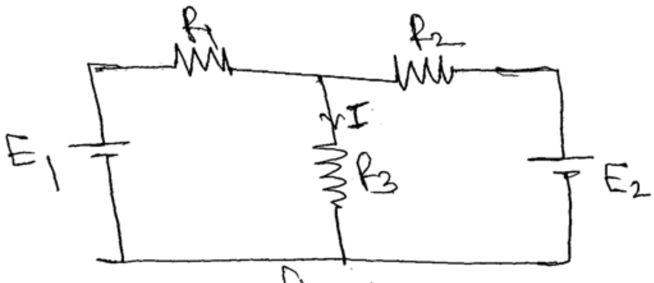


fig 7(b)

OR

Q8) a) State and explain Kirchhoff's laws. **[6]**

b) Find the equivalent resistance between A & B for the network shown below. Fig 8 (b). All resistance are in Ω. **[7]**

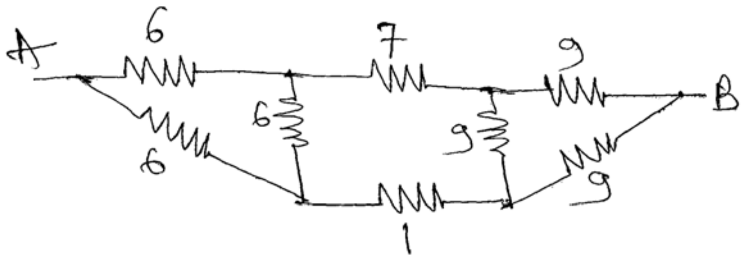


fig. 8 (b).

x x x

Total No. of Questions : 8]

SEAT No. :

P-4235

[Total No. of Pages : 3

[6001]-5006

F.E.

BASIC CIVIL & ENVIRONMENTAL ENGINEERING

(2015 Pattern) (Semester - I&II) (101005)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn whenever necessary.***
3) ***Figures to the right indicate full marks.***

Q1) a) Explain in brief the role of civil engineering in construction of Hydropower station. **[4]**

b) What is Prestress concrete? State any two application of PSC. **[4]**

c) State any four applications of Fluid Mechanics. **[4]**

OR

Q2) a) Define Settlement and state its types. Also mention various causes of settlement. **[4]**

b) How will you correlate the importance of Environmental Engineering, and development activities? Explain. **[4]**

c) What is combined footing? Under which situation it is constructed. **[4]**

Q3) a) The following consecutive readings were taken with a dumpy level and 4 m leveling staff. **[6]**

0.750, 1.435, 1.800, 0.400, 1.705, 1.525, 0.865, 1.300

The level was shifted after third and sixth reading. The first reading was taken on A.B.M. of R.L. 100.000 m. Calculate the reduced levels of remaining staff stations. Apply usual arithmetic check.

b) State the main objectives of environmental impact assessment. **[4]**

c) What are the adverse effects of over-exploitation of mineral resources on the environment? **[3]**

P.T.O.

OR

Q4) a) Explain the tabular form and procedure for computing R.L. of stations using collimation plane method. What do you mean by 'rise' and 'fall' of stations? **[5]**

b) Explain in detail the adverse environmental impacts of solid wastes. **[4]**

c) What is meant by sustainable development? State its importance in the present context. **[4]**

Q5) a) What is Roominess? How it is achieved during planning of building. **[4]**

b) Briefly explain the concept of Green building. **[5]**

c) How will you achieve the filling of more space under restricted conditions of planning? **[4]**

OR

Q6) a) On a plot of 25 m X 30 m, a building of G + I is proposed with a built up area of 400 sq.m on the-ground and first floor. Permissible FSI is 0.9. All margins will be 2 m as per bye-laws. **[5]**

Find :

i) Plinth area of building

ii) State with reason weather the plan will be sanctioned or not, based on allowable built up area as well as ground coverage.

b) Explain in brief the Sanitation as a principle of building planning. **[4]**

c) Define set back distance. Why it is necessary? **[4]**

Q7) a) When water is said to be polluted? What are the various causes of Water Pollution? **[4]**

b) Write a short note on Air pollution. **[4]**

c) Enlist any four non-conventional energy sources and explain any one in brief. **[4]**

OR

Q8) a) Write a short note on Geothermal Energy. **[4]**

b) Explain in brief the mechanism of production of Biogas energy. **[4]**

c) As a responsible member of Civil Society, How will you contribute yourself to reduce the Air pollution. **[4]**

Total No. of Questions : 8]

SEAT No. :

P4236

[Total No. of Pages : 4

[6001]-5007
F.E.
ENGINEERING GRAPHICS - I
(2015 Pattern) (Semester - I & II) (Credit System) (Theory) (102006)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6 and Q.No.7 or Q.No.8.***
2) ***Assume suitable data, if necessary.***
3) ***Retail all the construction lines.***

Q1) Question Statements

A line AB, 65 mm long has its end A 20 mm above H.P. and 25 mm in front of VP. The end B is 40 mm above H.P. and 65 mm in front of V.P. Draw the projections of AB and shows its inclination with H.P. **[12]**

OR

Q2) A square lamina of 50 mm side rests on one of the corners on the HP. The diagonal through that corner makes 30° to the VP. The two sides containing this corner make equal inclinations with the HP. The surface of the lamina makes 45° to the HP. Draw the TV and FV of the lamina. **[12]**

Q3) A tetrahedron of 80 mm long edges is held on one of its edge on HP such that the triangular face containing that edge is perpendicular to HP. Draw its projections of the tetrahedron when the edge which is on HP is inclined at 45° to VP. **[13]**

OR

Q4) a) Construct an Archimedean spiral for one revolution if the greatest radius vector is 70 mm and smallest radius vector is 10 mm. **[7]**

b) Draw the development of lateral surface of a hexagonal prism of base side 30 mm and axis height is 70 mm. **[6]**

Q5) Figure 1 shows a pictorial view of an object. By using first angle method of projections, draw: **[13]**

a) Front view

b) Top view

c) Right hand side view

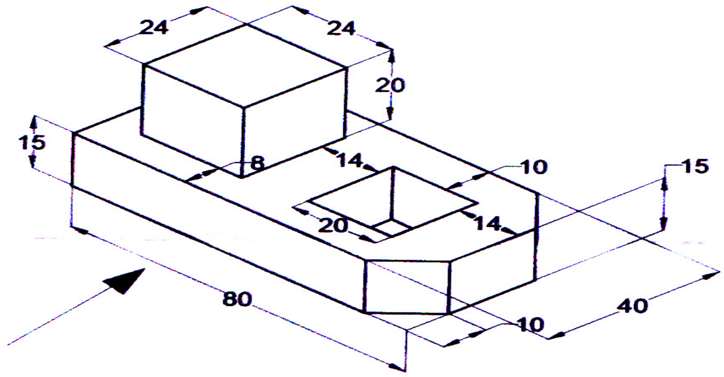


Figure - 1

OR

Q6) Figure 2 shows a pictorial view of an object. By using first angle method of projections, draw: **[13]**

a) Front view

b) Top view

c) Left hand side view

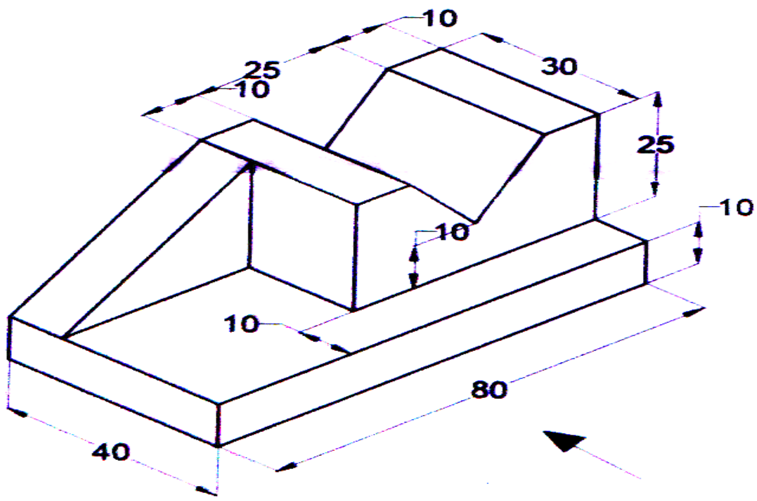
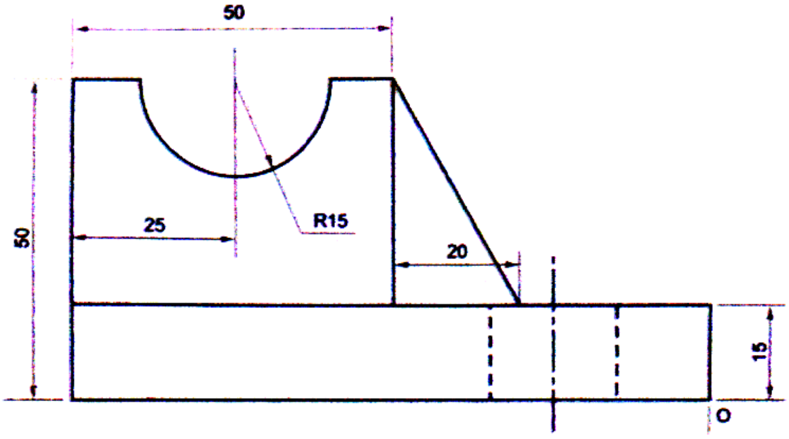
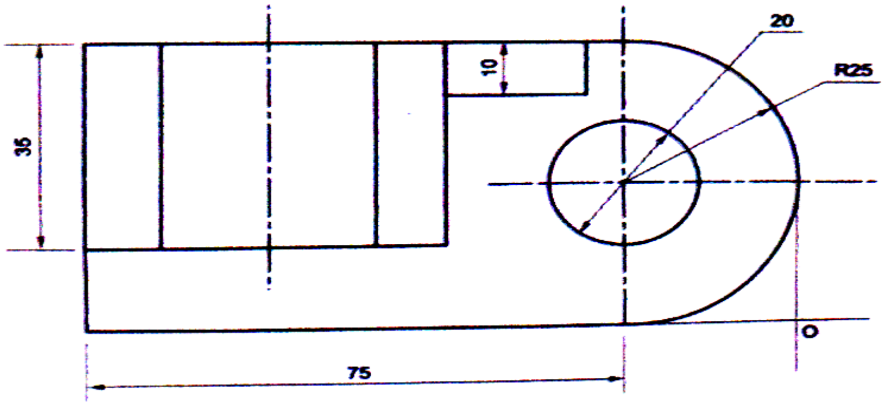


Figure - 2

Q7) The figure 3 shows Elevation (F.V) and Plan (T. V) of an object. Draw Isometric View and give basic dimensions in a view. **[12]**



Elevation

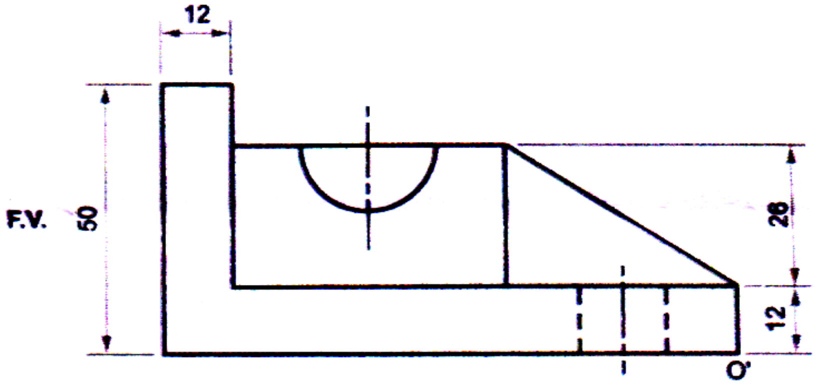


Plan

Figure - 3

OR

Q8) The figure 4 shows Front View and Top View of an object. Draw Isometric View and give basic dimensions in a view. **[12]**



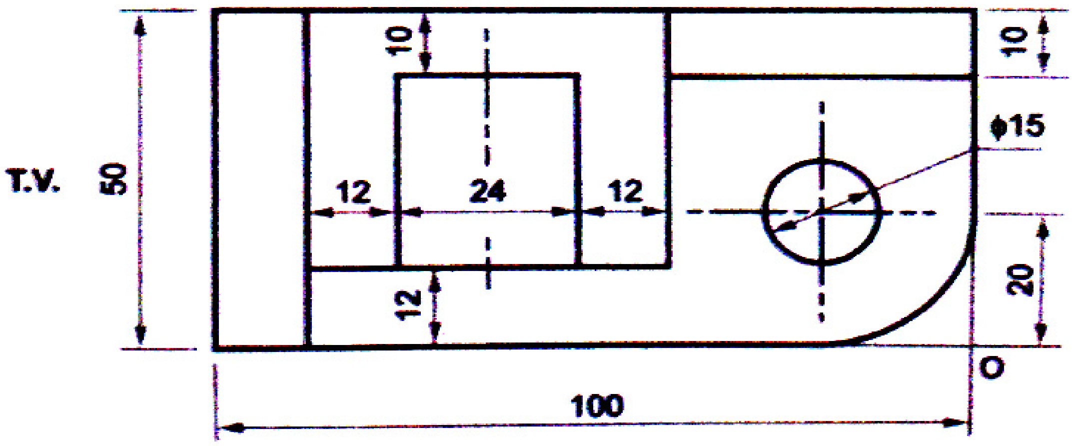


Figure - 4

Total No. of Questions : 8]

SEAT No. :

P-4333

[Total No. of Pages : 3

[6001]-5008
F.E.
ENGINEERING MATHEMATICS - II
(2015 Pattern) (Semester - I/II) (107008)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates :

1) *Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of electronic pocket calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a) Solve the following differential equations.

i) $\dfrac{dy}{dx} = \dfrac{x-2y+5}{2x+y-1}$ **[4]**

ii) $\left(xy-2y^2\right)dx+\left(3xy-x^2\right)dy=0$ **[4]**

b) The distance x descended by a parachuter satisfies the differential equation $\dfrac{dv}{dt} = g\left(t-\dfrac{v^2}{k^2}\right)$ where v is velocity, k,g constants, If $v = 0$ and $x = 0$ at time $t = 0$, show that $x = \dfrac{k^2}{g}\log\cosh\left(\dfrac{gt}{k}\right)$. **[4]**

OR

Q2) a) Solve : $\left(x^2+1\right)\dfrac{dy}{dx}+4xy = \dfrac{1}{\left(x^2+1\right)^2}$. **[4]**

b) i) A body originally at 100°C cools down to 60°C in one minute, the temperature of the air being 20°C. What will be the temperature of the body after two minutes from the original? **[4]**

P.T.O.

ii) The charge 'Q' on the plate of a condenser of capacity 'C' charged through a resistance 'R' by a steady voltage 'V' satisfies the differntial equation $R\frac{dQ}{dt}+\frac{Q}{C}=V$ If Q = 0 at t = 0, show that Q = CV[1– $e^{-t/RC}$] **[4]**

Q3) a) Find Fourier series representation for $f(x)=x^2, -\pi \le x \le \pi$ and $f(x+2\pi)=f(x)$. **[5]**

b) Prove that $\int_0^\infty e^{-h^2x^2}dx=\frac{\sqrt{\pi}}{2h}$. **[3]**

c) Trace the curve (any one) **[4]**

i) $y^2 (2a - x) = x^3$

ii) $r = a \sin 2\theta$

OR

Q4) a) Evaluate $\int_0^{2a} x\sqrt{2ax-x^2}\,dx$. **[4]**

b) Prove that **[4]**

$$\int_0^1 \frac{x^a-1}{\log x}dx=\log(a+1); a>0$$

c) Find the perimeter of the cardioide $r = a(1+\cos\theta)$. **[4]**

Q5) a) Prove that the two spheres

$x^2+y^2+z^2-2x+4y-4z=0$ and $x^2+y^2+z^2+10x+2z+10=0$ touch each other and find the coordinates of the point of contact. **[5]**

b) Find the equation of right circular cone whose vertex is at (0, 0, 0), semi-vertical angle $\frac{\pi}{4}$ and axis along the line $\frac{x}{2}=\frac{y}{-1}=\frac{z}{2}$. **[4]**

c) Find the equation of right circular cylinder of radius $\sqrt{6}$ whose axis is the line $\frac{x}{1}=\frac{y}{-1}=\frac{z}{1}$. **[4]**

OR

Q6) a) Show that the plane $x-2y-2z-7=0$ touches the sphere $x^2+y^2+z^2-10y-10z-31=0$. Also find the point of contact. **[5]**

b) Find the equation of right circular cone whose vertex is at (0, 0, 10) and whose intersection with the XoY plane is a circle of radius 5. **[4]**

c) Find the equation of right circular cylinder of radius 2 whose axis passes through (1, 2, 3) and has direction ratios 2, 1, 2. **[4]**

Q7) Attempt any two of the following.

a) Evaluate $\iint\limits_R y\,dxdy$, where R is the region bounded by $y=x^2$ and $y=x$. **[4]**

b) Evaluate $\int_0^{\log 2}\int_0^{x}\int_0^{x+y} e^x e^y e^z\,dxdydz$. **[5]**

c) Find the centre of gravity (C.G.) of the area of cardioide r = a(1+cosθ). **[4]**

OR

Q8) Attempt any two of the following.

a) Find the area bounded by the parabola y = x^2 and the line y = x. **[4]**

b) Find the volume of the region enclosed by the paraboloid $z=x^2+y^2$ and the cone $z=\sqrt{x^2+y^2}$. **[5]**

c) Find the moment of inertia (M.I.) of the portion of the parabola $y^2=4ax$, bounded by x - axis and the latus rectum about x - axis if density at each point varies as the cube of the abscissa. **[4]**

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Total No. of Questions : 6]

SEAT No. :

P-4334

[Total No. of Pages : 6

[6001]-5009

F.E. (Common)

ENGINEERING MECHANICS

(2015 Pattern) (101011) (Semester - I & II)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data, if necessary.*
4) *Use of electronic pocket calculator is allowed in the examination.*
5) *Use of cell phone is prohibited in the examination hall.*

Q1) A) Determine moment of all the three forces, 250N (30° with vertical), 300N (60° with horizontal), and 500N, about Lit 'A', acting on L-shape rod as shown in Fig. 1A. **[4]**

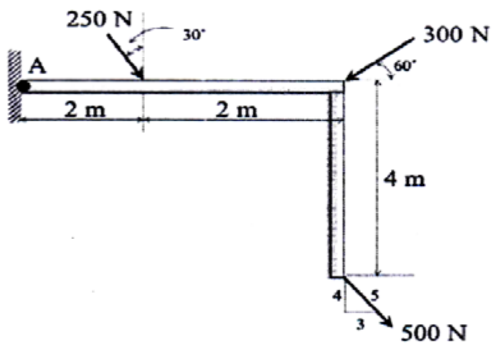

Fig. 1A

B) If the coefficient of kinetic friction between the 50-kg crate and the ground is $\mu_k = 0.3$, as shown in Fig. 1B. Determine the acceleration with which the crate moves. Also find its velocity when t = 3s. The crate starts from rest, and P = 200 N. **[4]**

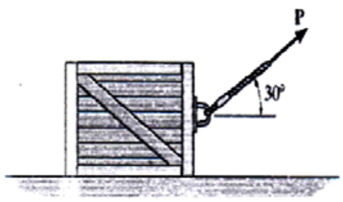

Fig. 1B

P.T.O.

C) The car moves in a straight line such that for a short time its velocity is defined by, $V = (3t^2 + 2t)$ m/s, where t is in seconds. Determine its position and acceleration when t = 3 s. Note when t = 0, s = 0. **[4]**

D) A tennis ball dropped from a height 800 mm rebounds back to a height of 250 mm. Determine the coefficient of restitution. **[4]**

OR

Q2) A) Determine the position of centroid of the shaded portion with respect to origin 'A' as shown in Fig. 2A. All dimensions are in mm. **[4]**

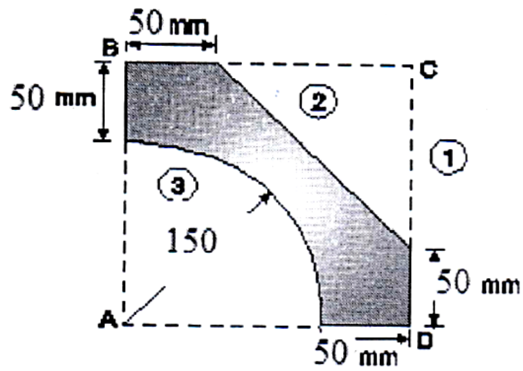

Fig. 2A

B) The system as shown in Fig. 2B, 4 kg block resting on the horizontal floor with coefficient of friction as 0.15, connected with 2 kg block by inextensible cable, which is passing over a frictionless pulley. Neglecting mass of the pulley, determine the acceleration of the 2 kg block with which it moves after releasing from rest. **[4]**

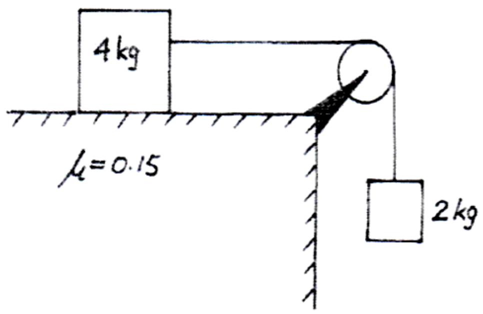

Fig. 2B

C) The conveyor belt is designed to transport packages horizontally. Each 10-kg package has a coefficient of kinetic friction $\mu_k = 0.15$. If the speed of the conveyor is 5 m/s, and then it suddenly stops, determine the time taken by the package to come to rest. Use Impulse-momentum equation. **[4]**

D) A package is projected up, on the 15° inclination as shown in Fig. 2D. from 'A' with an initial velocity of 8 m/s. Knowing that the coefficient of kinetic friction between the package and the incline is $\mu_k = 0.12$, determine the maximum distance 'd' that the package will move up the incline till 'B'. Use work-Energy principle. **[4]**

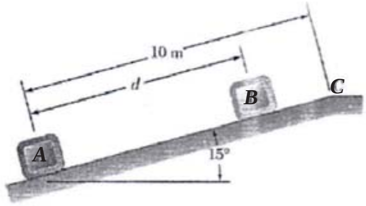

Fig. 2D

Q3) A) The 'I' joist bean AB of span 6 m supported with hinge 'A' and Roller 'B', as shown in Fig. 3A. Determine the support reactions. **[6]**

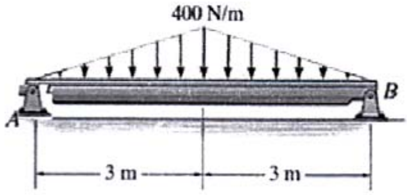

Fig. 3A

B) Determine the forces in cables AC and AB needed to hold the 20-kg ball D in equilibrium, as shown in Fig. 3B. Take F = 300 N and d = 1 m. **[5]**

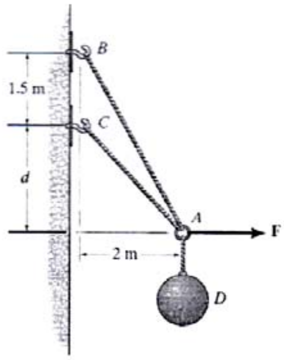

Fig. 3B

C) The rectangular 3m × 10m, steel plate subjected to four forces, as shown in Fig. 3C. Determine the resultant force in magnitude and direction w.r.to A. **[6]**

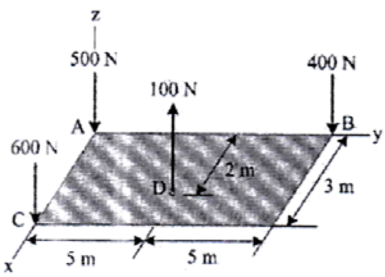

Fig. 3C

OR

Q4) A) Determine the support reactions for the beam AB of 8m span, loaded and supported as shown in Fig. 4A. **[6]**

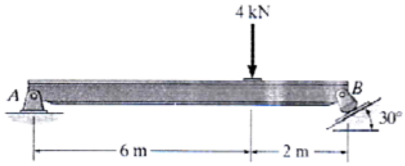

Fig. 4A

B) Three cables meeting at point A as shown in Fig. 4B. Find magnitude of the tension developed in each cable AB, AC and AD, supporting 50 N earthen pots. [OD = 1.5m,; A from y =1.5m; A from x = 2m]. **[6]**

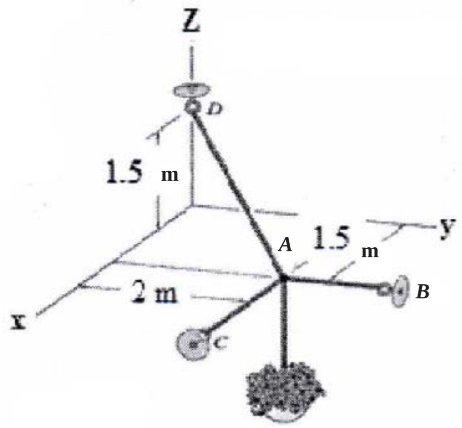

Fig. 4B

C) The I joist supports UVL (900 N/m) for 3 m length and UDL (600 N/m) for 3 m length, as shown in Fig. 4C. Determine the support reactions at hinge B and roller A. Neglect the self-weight of the joist. **[5]**

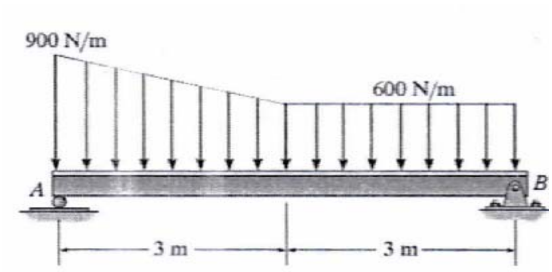

Fig. 4C

Q5) A) A ladder, 5 meters, long rests on a horizontal ground and leans against a smooth vertical wall at an angle 70° with the horizontal. The weight of the ladder is 900 N and acts at its middle. Calculate the coefficient of friction between the ladder and the floor, just to have equilibrium. **[6]**

B) Determine the forces in all the members of the truss loaded and supported as shown in the Fig. 5B. Tabulate the result with magnitude and name of force in the members. **[6]**

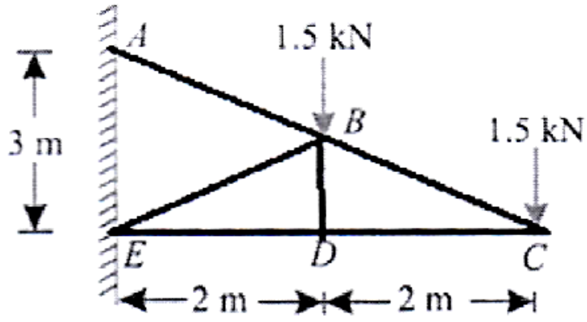

Fig. 5B

C) A block of 10 kg hanging through a frictionless cable and kept at rest by applying a force of 'F' N on other side of the cable, which is passing through the pulley as shown in the Fig. 5C. Determine the range of force 'F' required to keep the block in rest, if the lap angle between cable and pulley is 145°. Take $\mu_s = 0.25$. **[5]**

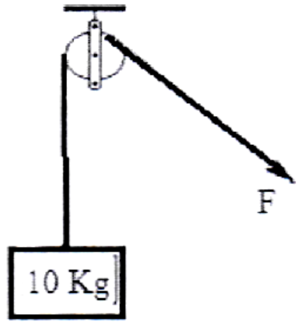

Fig. 5C

OR

Q6) A) Cable ABCD is loaded with 30 kN at 'B' and 22.5 kN at 'C' with supports as shown in the Fig. 6A. If d = 0.75 m, determine the component of reaction at A & maximum tension in the cable. **[6]**

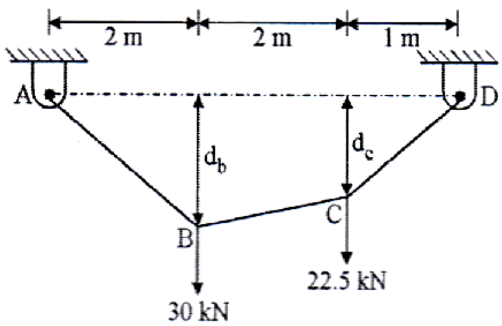

Fig. 6A

B) A 50 kg block resting on rough horizontal floor with coefficient of friction between floor and block as 0.25, applied with force P inclined upward at an angle 30° with horizontal as shown in Fig. 6B. Determine the magnitude of the force required just to start the motion of the block. **[6]**

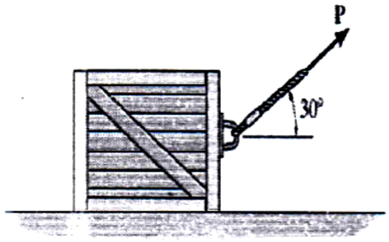

Fig. 6B

C) Determine the forces in the members BC, DE and BD of the truss loaded and supported as shown in the Fig.5B, using section method. Tabulate the result with magnitude and nature of force in the members. **[5]**

Total No. of Questions : 8]

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P4237

[Total No. of Pages : 2

[6001]-5010
F.E. (Common)
BASIC MECHANICAL ENGINEERING
(2015 Pattern) (Credit System) (Semester - I & II) (End Sem) (102013)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.***
2) ***Neat Diagram must be drawn whenever necessary.***
3) ***Figures to the right indicates full marks.***
4) ***Assume suitable data, if necessary.***
5) ***Use of non-programmable electronic Calculator is allowed.***

Q1) a) Draw neat labeled diagrams of : **[6]**

i) Disc Brake

ii) Ball bearing

b) Define following mechanical properties of material: **[6]**
Resilience, Brittleness, Hardness

OR

Q2) a) Draw labeled sketches with explanation of chain & Sprocket, V belt with Pulleys. **[6]**

b) Define machine. Draw and explain the working of slider crank mechanism. **[6]**

Q3) a) What is casting Process? Explain Sand Casting process with suitable sketch. **[7]**

b) Draw and explain, Radial drilling machine. **[6]**

OR

Q4) a) Explain with neat sketch, any four sheet metal shearing processes. **[6]**

b) Draw block diagram of lathe machine and explain the function of carriage, tailstock, lead screw. **[7]**

P.T.O.

Q5) a) With neat sketch compare the terms-atmospheric pressure, absolute pressure and gauge pressure. **[4]**

b) Explain measurement of pressure using U tube manometer. **[4]**

c) A cold storage is to be maintained at - 5° C, while the surroundings are at 35° c. The heat leakage from surroundings into the system is estimated to be 29KW. The actual COP of the refrigeration plant is $1/3^{rd}$ of an ideal plant working between the same temperatures. Find the power required to drive the plant. **[5]**

OR

Q6) a) Explain with neat sketch, open system, closed system and isolated system. **[4]**

b) State Zeroth law and First law of thermodynamics. **[4]**

c) A U-tube manometer is used to measure pressure of oil having specific gravity of 0.85 in a pipe line. The oil-mercury interface is 1.8m above the centerline of the pipe. If the difference shown by manometer is 45cm, calculate the oil pressure in the pipeline. Draw the sketch of the system. Take the density of mercury as $13600 Kg/m^3$. **[5]**

Q7) a) Draw block diagram of nuclear power plant and explain the energy transfer in it with its disadvantages. **[6]**

b) Differentiate between two stroke and four stroke engine. **[6]**

OR

Q8) a) Explain with neat sketch, working of centrifugal pump. **[6]**

b) With neat sketch explain working of household refrigerator. **[6]**