Total No. of Questions : 9]

SEAT No. :

PB3586

[Total No. of Pages : 5

[6260]-1
F.E.
ENGINEERING MATHEMATICS-I
(2019 Credit Pattern) (Semester -I/II) (107001)

Time :2½Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Q.1 is Compulsory.***
2) ***Answer Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***
5) ***Neat diagrams must be drawn wherever necessary.***
6) ***Use of electronic pocket calculator is allowed.***

Q1) Write the correct option for the following MCQs. **[10]**

a) If $u = x^3 + y^3$ then $\frac{\partial^2 u}{\partial x \partial y} = \cdots ?$ **[2]**

i) 3 ii) -3

iii) 2 iv) 0

b) If $x = uv, y = \frac{u}{v}$ the $\frac{\partial(x,y)}{\partial(u,v)} = \cdots ?$ **[2]**

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

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

c) Rank of matrix$A=\begin{bmatrix} 1 & 1 & 1 \\ 0 & -1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ is ....? **[2]**

i) 0 ii) 1

iii) 2 iv) 3

P.T.O.

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

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

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

e) If $A^{-1}=A'$ then matrix A is ....? **[1]**

i) Orthogonal ii) Singular
iii) Non-Singular iv) None of above

f) If $u=x^3+4y-3x$, $\frac{\partial u}{\partial x}$=....? **[1]**

i) 4 ii) $3x^2-3$

iii) $3x^2+4y$ iv) $3x^2+1$

Q2) a) If $u=x^y+y^x$,find $\frac{\partial^2 u}{\partial x\partial y}$ **[5]**

b) If $u=\log\left(\frac{x^3+y^3}{x^2+y^2}\right)$, find the value of $x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}$ **[5]**

c) If $u=f(y-z,z-x,x-y)$, Prove that $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}=0$ **[5]**

OR

Q3) a) If $x^2=au+bv$ and $y^2=au-bv$, prove that $\left(\frac{\partial u}{\partial x}\right)_y\left(\frac{\partial x}{\partial u}\right)_v=\frac{1}{2}$ **[5]**

b) If $u=\sin^{-1}\left(\frac{y}{x}\right)+\sqrt{x^2+y^2}$, find the value of $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$ **[5]**

c) If $x=\frac{\cos\theta}{u}, y=\frac{\sin\theta}{u}$ and $z=f(x,y)$,then show that $u\frac{\partial z}{\partial u}-\frac{\partial z}{\partial\theta}=(y-x)\frac{\partial z}{\partial x}-(y+x)\frac{\partial z}{\partial y}$ **[5]**

Q4) a) If $x = uv$ and $y = \frac{u+v}{u-v}$, find $\frac{\partial(u,v)}{\partial(x,y)}$ **[5]**

b) Examine for functional dependence:

$u = \frac{x+y}{1-xy}, v = \tan^{-1} x + \tan^{-1} y.$ If dependent find the relation between them. **[5]**

c) Discuss maxima and minima of $f(x,y) = x^3 + y^3 - 3axy \quad a > 0.$ **[5]**

OR

Q5) a) Prove that $JJ' = 1$ for the transformation $x = u\cos v, y = u\sin v$ **[5]**

b) Find the percentage error in computing the parallel resistance *r* of two resistances r_1 and r_2 from the formula $\frac{1}{r} = \frac{1}{r_1} + \frac{1}{r_2}$ where r_1 and r_2 are both in error by +2% each. **[5]**

c) Find maximum value of $u = x^2y^3z^4$ such that $2x + 3y + 4z = a$ by langrange's method. **[5]**

Q6) a) Find for what values of k, the set of equations **[5]**

$$2x - 3y + 6z - 5t = 3$$
$$y - 4z + t = 1$$
$$4x - 5y + 8z - 9t = k$$

has i) No solution

ii) An intinite number of solutions.

b) Examine for linear dependence of vectors **[5]**
(1,–1,1) , (2,1,1) and (3,0,2)

c) Show that $A = \frac{1}{3}\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix}$ is orthogonal. **[5]**

OR

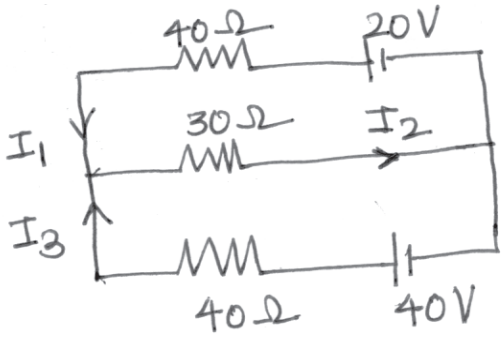
Q7) a) Examine for consistency the following set of equations and obtain the solution if consistent. **[5]**

$$2x-y-z=2$$
$$x+2y+z=2$$
$$4x-7y-5z=2$$

b) Examine for linear dependence of vectors **[5]**

$(1,2,4),(2,-1,3),(0,1,2)$.

c) Determine the currents in the network given in figure below. **[5]**



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

$$A=\begin{bmatrix}1 & 1 & 1\\ 0 & 2 & 1\\ 0 & 0 & 3\end{bmatrix}.$$

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

$$A=\begin{bmatrix}1 & 1 & -2\\ -1 & 2 & 1\\ 0 & 1 & -1\end{bmatrix}$$ to the diagonal form. **[5]**

OR

Q9) a) Find the eigen values and eigen vectors of the following matrix

$A=\begin{bmatrix} 1 & -2 \\ -5 & 4 \end{bmatrix}$. **[5]**

b) Verify cayley Hamilton theorem for $A=\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & -3 & 3 \end{bmatrix}$. Hence find A^{-1}.

[5]

c) Reduce the following quadratic form to the Sum of the squares form.

$3x^2 + 3y^2 + 3z^2 + 2xy + 2xz - 2yz.$ **[5]**

Total No. of Questions : 9]

SEAT No. :

PB3587

[Total No. of Pages : 4

[6260]-2
F.E. (Common)
ENGINEERING PHYSICS
(2019 Credit Pattern) (Semester - I/II) (107002)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Q. 1 is compulsory. Answer Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagram must be drawn wherever necessary.***
4) ***Use of non-programmable Electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Physical Constants:

- ***Plank's constant, $h = 6.63 \times 10^{-34}$ J.S***
- ***Mass of electron, $m_e = 9.1 \times 10^{-31}$ kg***
- ***Charge on electron = 1.6×10^{-19} C***

Q1) Write the correct option with answers for the following questions (1mark each) **[10]**

a) De Broglie wavelength for matter waves associated with a matter particle is _____its Energy.

i) Inversely proportional to square of

ii) Directly proportional to

iii) Inversely proportional to the square root of

iv) Directly proportional to the square root of

b) A well behaved wave function satisfies which mathematical conditions.

i) Finite ii) Single valued

iii) Normalizable iv) All of the above

c) According to Heisenberg Uncertainty principle, in a narrow wave packet of de Broglie wavelength _____of a particle can be predicted correctly.

i) Position

ii) Momentum

iii) Position and momentum both

iv) Neither position nor momentum

P.T.O.

d) At absolute zero (T = 0 k), a semiconductor would be

i) Perfect semiconductor ii) Insulator

iii) Conductor iv) Intrinsic semiconductor

e) The Hall effect is true for

i) Semiconductors only and not metals

ii) Metals only and not semiconductors

iii) Both metals and semiconductors

iv) Insulators

f) The relation between magnetization (M), susceptibility (χ) and Magnetic field strength (H) is

i) $\chi = M \times H$ ii) $\chi = H/M$

iii) $\chi = M + H$ iv) $\chi = M/H$

g) The relation between magnetic induction (B), Magnetic flux (ϕ), area (A) and is

i) $\phi = B/A$ ii) $\phi = BA$

iii) $\phi = B - A$ iv) $\phi = A/B$

h) The expulsion of magnetic flux from within the superconductor below Critical temparature is know as

i) Magnetic effect ii) Expulsion effect

iii) Meissner effect iv) Josephson effect

i) X rays or gamma rays are used in radiography testing technique due to which of their property.

i) High frequency ii) High wavelength

iii) High velocity iv) Low frequency

j) A quantum dot (nanoparticle) has all dimensions in the range of

i) 100 nm to 1μm ii) 1 - 100 nm

iii) 1 μm to 100 μm iv) 100 μm and above

Q2) a) Derive schrodinger's time independent equation. **[6]**

b) What is the Heisenberg uncertainty Principle/ Explain it using narrow and broad wave packets. **[5]**

c) The lowest energy of an electron trapped in a potential well is 4.2 eV. Determine the width of the potential well in AU. **[4]**

OR

Q3) a) For a particle enclosed in a rigid box of infinite potential well, derive the equation for energy of the particle. Why is this energy quantized? **[6]**

b) What is the de Broglie hypothesis? Explain in brief properties of matter waves (any four). **[5]**

c) An electron is confined to a potential well of length 1.5 AU. Calculate the minimum uncertainty in its velocity (assume product of uncertainities equal to 'h'). **[4]**

Q4) a) With a neat and labeled diagram explain the Hall effect. Derive expression for Hall voltage. **[6]**

b) Difine Fermi level for a semiconductor. Draw a neat and labeled energy diagram for a PN junction diode showing Fermi levels when it is in **[5]**

(i) Zero bias (equilibrium)

(ii) Forward bias

c) A sample of intrinsic germanium has a carrier concentration of 4.41×10^{22} / cm^3. If the donor impurity is added in the ratio $1:10^7$ atoms / cm^3, determine resistivity of the sample. [Given, mobility of electrons, μ_e = 3800 cm^2/V.s. **[4]**

OR

Q5) a) Derive the expression for electrical conductivity of a semiconductor. Discuss how this equation is modified for intrinsic, N-type and p-type semiconductors. **[6]**

b) Define efficiency of solar cell. Explain any four ways by which the efficiency of solar cell can be improved. **[5]**

c) An n-type semiconductor has a thickness of 0.15 mm and a current of 1mA is flowing along its length. Calculate Hall voltage developed along its width if a magnetic field of 2T is applied perpendicular to its thickness. [Hall coefficient, $R_H = 3.68\times10^{-4} m^3/C$]. **[4]**

Q6) a) Differentiate between diamagnetic, paramagnetic and ferromagnetic materials. (Any three points). **[6]**

b) What is super conductivity? Explain any two applications of superconductors in brief. **[5]**

c) For Lead, the critical magnetic field at 0K , Hc (0) is 8×10^5 A/m. and it has a transition temparature (Tc) of 7.26 K. In a certain application, Lead has to be used as a superconductor subjected to a magnetic field of Hc(T) = 4×10^4 A/m. At what maximum temperature it can be operated? **[4]**

OR

Q7) a) What is the Meissner effect? Discuss the reason why it is observed? Showthat superconductors exhibit perfect diamagnetism below the critical temparature. **[6]**

b) Explain the process of recording and retrieving (reading) data in magnetic storage devices. **[5]**

c) Explain brief:

i) Magnetic Susceptibility (χ)

ii) Absolute permeability (μ) **[4]**

Q8) a) What is echo sounding? Using this technique, explain how ultrasonic waves can be used for flaw detection. **[6]**

b) What is quantum confinement? On its basis explain why nanoparticles exhibit different properties than corresponding bulk materials. **[5]**

c) State applications of nanotechnology in the field of electronics (any four). Explain any one application in brief. **[4]**

OR

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

b) State the objectives of Non-Destructive Testing. Differentiate between destructive and non-destructive testing (any two points). **[5]**

c) An ultrasonic pulse of frequency 100 kHz is sent through a block of aluminum with velocity 6320 m/s and. The echo is recorded after 1.45 microseconds. Calculate the thickness of the block and the wavelength of the ultrasonic pulse. **[4]**

Total No. of Questions : 8]

SEAT No. :

PB3588

[Total No. of Pages : 2

[6260]-3
F.E.
SYSTEMS IN MECHANICAL ENGINEERING
(2019 Pattern) (Semester-I/II) (Credit System) (102003)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt question Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must he drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) Classify automobiles based on various considerations and specify examples of each type. **[7]**

b) State importance of vehicle specification. Provide vehicle specifications for any two-wheeler. **[7]**

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

OR

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

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

c) Write a short note on cost analysis of the vehicle. **[4]**

Q3) a) A pinion with 110 mm 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. Determine. **[7]**

i) Gear ratio

ii) Number of teeth on gear and

iii) Speed of the gear.

b) State importance of suspension system. Explain telescopic suspension system with neat sketch. **[7]**

c) Draw a block diagram of fuel supply system for petrol engines with its components. **[3]**

OR

P.T.O.

Q4) a) Explain various components mounted on the chassis with neat sketch. **[7]**

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

c) Explain working of water-cooling system in vehicle with neat diagram. **[3]**

Q5) a) Explain sand casting process with neat sketch. State its advantages and disadvantages. **[7]**

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

c) Explain concept of Internet of Things (IoT) and its applications in manufacturing. **[4]**

OR

Q6) a) Define metal forming process. Discuss extrusion and drawing process with neat sketch. **[7]**

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

c) Explain a process of product development using 3D printing process. **[4]**

Q7) a) With the help of block diagram, explain working of electric geyser. State various specifications for an electric geyser. **[7]**

b) Explain working of a printer with block diagram. **[7]**

c) Draw neat sketch of water pump used for overhead tank. **[3]**

OR

Q8) a) State various applications of springs in domestic appliances. With neat sketch, explain any one mechanism making use of spring. **[7]**

b) Why product specifications are important? Explain the specifications for refrigerator and air conditioner. **[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 2200W. Calculate the efficiency of the motor. (Use $g = 9.81\ m/s^2$) **[3]**

Total No. of Questions : 9]

SEAT No. : ____

PB-3589

[Total No. of Pages : 4

[6260]-4

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 Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic table slide rule, mollar charts, electronic pocket calculator and steam tubles is allowed.***
6) ***Assume Suitable data, if necessary.***

Q1) Multiple Choice Questions : **[10]**

i) CDs, DVDs can be mode from -

a) Polycarbonate b) Polypropylene

c) Polyacetylene d) Kevlar

ii) Matrix phase in a composite is formed by -

a) Fibers b) Particulars

c) Polymer d) Flakes

iii) Which of the following is used for N-doping in conducting polymers -

a) Iodine b) Chloride

c) Sodium d) Fluoride

iv) NCV = GCV – _____ X 587 kcal/kg

a) 0.90H b) 9.0H

c) 0.9H d) 0.09H

P.T.O.

v) Cooling correction should be _____ during calculation of GCV of a fuel by bomb calorimeter, correctly

a) added
b) subtracted
c) multiplied
d) neglected

vi) According to lambert's law

a) $A \alpha x$
b) $A \alpha c$
c) $A = -\log\frac{1}{T}$
d) $A = -\log T$

vii) Which of the following is a chromophore

a) C = C
b) C – OH
c) C – NH_2
d) C – Br

viii) The possible number of fundamental mode of vibration in case of H_2O molecule is

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

ix) Rate of corrosion _____ with decrease in pH of metal

a) Decrease
b) Increase
c) Remain same
d) Initially increase and then remain constant

x) Corrosion between the dissimilar metal is called as -

a) Galvanic corrosion
b) Dry corrosion
c) Concentration corrosion
d) Oxidation corrosion

Q2) a) What are biodegradable polymer. Explain three factors responsible for biodegradation. Give the structure of PHBV and its application. **[6]**

b) Define nanomaterials. How are nanomaterial classified on the basis of dimension? Give example of each. **[5]**

c) What are Quantum dots? Give properties and application of quantum dots. **[4]**

OR

Q3) a) What is conducting polymer? Explain intrinsically and extrinsically conducting polymer with example. how the conductivity of trans polyacetylene can be improved? **[6]**

b) Explain structure of graphene with diagram. Give its four application. **[5]**

c) Give structure, properties and applications of PPV as an electroluminiscent polymer. **[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) Give the principle of fractional distilation of petroleum crude with diagram. Write composition and boiling range and use of any one fraction obtained during refining of petroleum. **[5]**

c) The following observations were noted in the Boy's gas calorimeter experiments - **[4]**

Valume of gas burnt at STP = 0.15 m^3

Mass of cooling water used = 27 kg

Temperature of Inlet water = 24.1°C

Temperature of outlet water = 29.8°C

Mass of steam condensed = 0.04 kg

Find GCV and NCV of the fuel

OR

Q5) a) Draw net labeled diagram with principle of Bomb calorimeter. Give construction and working of Bomb calorimeter to determine GCV of a fuel. State the formula of GCV. **[6]**

b) What is power Alcohol. Give procedure for preparation of ethanol with reaction. Give any two advantages of power alcohol. **[5]**

c) A sample of coal was analysed as follows - Exactly 1.50 gm coal sample was heated for 1 hr at 105–110°C, the residue weight 1.435 gm. The crucible next was covered with a vented lid and strongly heated for exactly 7 min at 950° $\pm$ 20°C. The residue weight 1.027 gm. The crucible was then heated without cover, until a constant weight was obtained. The last residue was found to weight 0.117 gm. Calculate the percentage results of above analysis. **[4]**

Q6) a) Give the principle of IR spectrophotometer with help of block diagram. Explain any four application of IR spectroscopy. **[6]**

b) Explain mode of vibration with stretching and bending vibrations. **[5]**

c) Define - **[4]**

i) Hypochromic shift ii) Bathochromic shift

iii) Beer's law iv) Chromophore

OR

Q7) a) Explain different types of electronic transitions with diagram which occurs an absorption of uv-visible radiations by an organic molecule. State the forbidden transition. **[6]**

b) Give any five application of uv–visible spectroscopy. **[5]**

c) What are conditions of absorption of IR radiations by the molecule. **[4]**

Q8) a) Explain Hydrogen evolution and oxygen absorption mechanism of wet corrosion. **[6]**

b) Explain cathodic protection method using sacrificial anode with respect to principle diagram, method and applications. **[5]**

c) Discuss any four factors w.r.t. nature of metal affecting rate of corrosion. **[4]**

OR

Q9) a) State the pilling-Bedworth Ratio with their significance. Give reaction involved and mention the type of oxide film formed on the oxidation corrosion of Fe, Al, Ag and Mo. **[6]**

b) What is galvanization? Explain process with diagram. Give any two application of galvanization. **[5]**

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

⌘⌘⌘

Total No. of Questions : 8]

SEAT No. : ____

PB3590

[Total No. of Pages : 3

[6260]-5

F.E. (All Branches)

BASIC ELECTRICAL ENGINEERING

(2019 Pattern) (Semester - I & II) (Credit System) (103004)

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

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) ***Assume suitable data, if necessary.***
5) ***Use of non-programmable electronic pocket calculator is permitted.***

Q1) a) Derive the expression for resonant frequency in a series RLC circuit. **[4]**

b) Prove that a pure inductor excited by sinusoidal voltage source never consumes any power. Draw the circuit diagram and write all necessary equations in steps. **[6]**

c) A voltage given by v = 200 sin wt is applied across 50 Ω pure resistor. Obtain the expressions for instantaneous current and instantaneous power for this circuit. Also calculate rms value of current and power consumed. **[8]**

OR

Q2) a) Define admittance of a circuit and hence draw the admittance triangle for a capacitive circuit. **[4]**

b) Obtain the expressions for instantaneous power and average power in a series R-L circuit excited by purely sinusoidal voltage. **[6]**

c) An R-C series circuit dissipates 100 W at 0.75 leading power factor when connected across single phase. 230 V. 50 Hz sinusoidal AC supply. Calculate: **[8]**

i) current drawn

ii) impedance in polar and rectangular form

iii) resistance of the circuit and

iv) value of capacitance

P.T.O.

Q3) a) Define the following terms in the context of polyphase AC circuits: **[3]**

i) Symmetric AC supply

ii) Phase sequence

iii) Balanced Load

b) Derive the emf equations of a single phase transformer. **[6]**

c) A delta connected balanced load consists of three coils; each of resistance 6 Ω and inductive reactance 8 Ω supplied by 400V, 3-phase AC. Determine **[8]**

i) impedance per phase

ii) phase current and line current

iii) power factor of the circuit

iv) total power absorbed

OR

Q4) a) State any three advantages offered by an autotransformer. **[3]**

b) A direct loading test is performed on a 1 KVA, 230V/115 V, 50 Hz single phase transformer. Draw the connection diagram showing all necessary measuring instruments with appropriate ranges and determine the rated primary and secondary current. **[6]**

c) Obtain the relationship between line current and phase current, line voltage and phase voltage for 3-phase star connected balanced inductive load with the help of neat circuit diagram and phasor diagram. Assume phase sequence as RYB. **[8]**

Q5) a) A practical voltage source supplies a load resistance R_L Draw the circuit representation and the V_L - I_L characteristics of this arrangement. **[4]**

b) Obtain the formulae for converting a delta connection of resistors into its equivalent star connection. **[6]**

c) Write the Kirchhoffs Voltage Law equations for the circuit shown in Fig. below and hence find the current through branch AB. All resistance values are in Ω. **[8]**

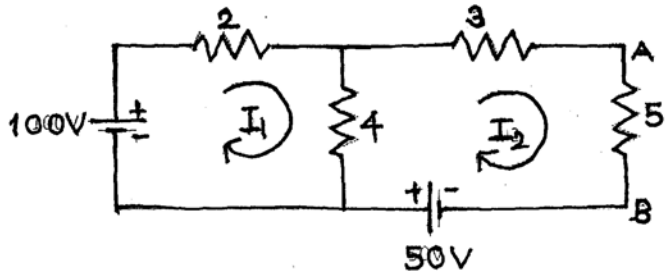


Fig. Q.5 (c)

OR

Q6) a) State and explain Kirchhoff's Laws for DC circuits. **[4]**

b) Find the equivalent resistance obtained across B and C terminals for the circuit shown in Fig. below. All resistance values are in Ω. **[6]**

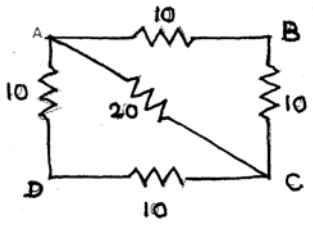


Fig. Q. 6 (b)

c) State Superposition Theorem. Explain the steps to apply Superposition Theorem for finding the current through branch A B of the circuit shown in fig. below. **[8]**

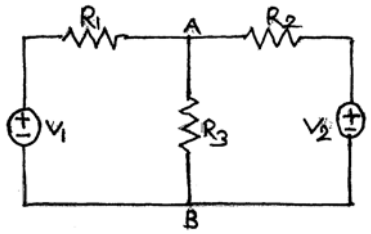


Fig. Q. 6 (C)

Q7) a) Specify the following in case of a Lithium Ion Battery: **[3]**

i) Cathode material

ii) Anode material

iii) Electrolyte material

b) Prove that $\alpha_2 = \dfrac{\alpha_1}{1+\alpha_1(t_2 - t_1)}$ where all terms have their usual meaning. **[6]**

c) Define insulation resistance and hence derive an expression for insulation resistance of a single core cable. **[8]**

OR

Q8) a) Define resistance temperature coefficient (RTC) and write its unit. **[3]**

b) An electric pump lifts 72 m^3 of water per hour to a height of 15 m. If the overall efficiency of the system is 70 %, find the input power. If the pump is used for 4 hours in a day, find the daily cost of energy at Rs. 10 per unit. **[6]**

c) Explain the following in case of a Lead Acid Battery: **[8]**

i) Construction and working

ii) Maintenance procedure

iii) Any two applications

Total No. of Questions : 8]

SEAT No. : ____

PB3591

[Total No. of Pages :2

[6260]-6

F.E.

BASIC ELECTRONICS ENGINEERING

(2019 Pattern) (Semester-I/II) (Credit System) (104010)

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

Q1) a) i) Convert $(436)_8$ to Hexadecimal.

ii) Convert $(4CA)_{16}$ to octal.

iii) $(4C8.2)_{16}$ to Decimal.

iv) Perform (7-5) using 2's complement method.

v) (1101*110)

vi) Perform (111011.11+100100.01)

[6]

b) With the help of truth table, Give the expression of AND, OR, NOT, NAND, NOR, EX-OR gates. **[6]**

c) Explain SR-Flip-Flop with the help of their truth table, logic diagram. **[6]**

OR

Q2) a) State and prove De-Morgan's Theorems. **[6]**

b) Draw and Explain the working of Full Adder using two half adders with a Truth Table and give its sum and carry equation. **[6]**

c) Compare Microprocessor and Microcontroller. **[6]**

Q3) a) Explain working of Digital Multimeter with its block diagram. **[6]**

b) Draw and explain block diagram Digital Storage Oscilloscope. **[6]**

c) Explain the block diagram of regulated DC power supply. **[5]**

OR

P.T.O.

Q4) a) Draw and explain block diagram of Function Generator. **[6]**

b) Explain Auto transformer and list its applications? **[6]**

c) Explain how to convert Galvanometer to Analog voltmeter and how to use it as multi-range voltmeter? **[5]**

Q5) a) Explain working of LVDT. Draw its construction diagram. Write advantages, disadvantages and its application. **[6]**

b) Explain operation of bio-sensor. State its application. **[6]**

c) Define Selection Criteria of Sensors. **[5]**

OR

Q6) a) Explain Thermocouple with its construction, working, advantages, disadvantages and application. **[6]**

b) Explain the working of LDR. State its Applications. **[6]**

c) Explain working of RTD. Draw its construction diagram. State its Application. **[5]**

Q7) a) Explain need of modulation. State different types of modulation techniques used in electronics communication. **[6]**

b) Draw and explain block diagram of basic communication system. **[6]**

c) Explain block diagram of high level AM transmitter. **[6]**

OR

Q8) a) Draw and explain different types of cables used in electronics communication. **[6]**

b) Draw and explain Super heterodyne FM receiver. **[6]**

c) Draw and explain block diagram of GSM System. **[6]**

Total No. of Questions : 8]

SEAT No. : ____

PB3592

[Total No. of Pages : 6

[6260]-7

F.E. (Common)

ENGINEERING MECHANICS

(2019 Pattern) (Credit System) (Semester - I/II) (101011)

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

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 sketches must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***
5) ***Use of electronic pocket calculator is allowed.***
6) ***Use of cell phone is prohibited in the examination hall.***

Q1) a) A 1.5 m cable placed around a crate as shown in Fig. 1 a. If the mass of the crate is 300 kg, determine the tension in the cable. **[7]**

b) A square mat foundation supports four column as shown in Fig. 1 b. Determine the magnitude and point of application of the resultant with respect to origin. **[7]**

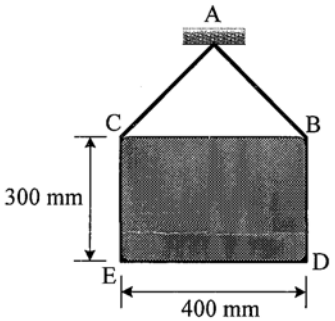


Fig. 1 a

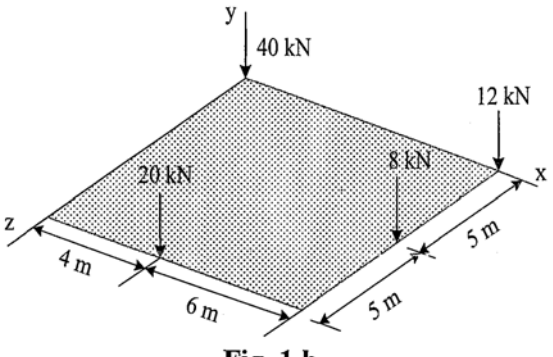


Fig. 1 b

c) Explain in brief free body diagram, active and reactive forces with suitable sketch. **[4]**

OR

P.T.O.

Q2) a) The boom is intended to support two vertical loads, F_1 and F_2 as shown in Fig. 2 a. If the cable CB can sustain a maximum load of 1500 N before it fails, determine the critical loads F_1 and F_2 if $F_1 = 2F_2$. Also determine the reaction at A. **[7]**

b) The square steel plate has a mass of 1800 kg with mass center G as shown in Fig. 2 b. Determine the tension in each cable so that the plate remains horizontal. **[7]**

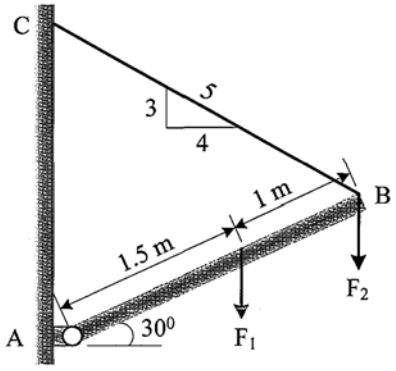


Fig. 2 a

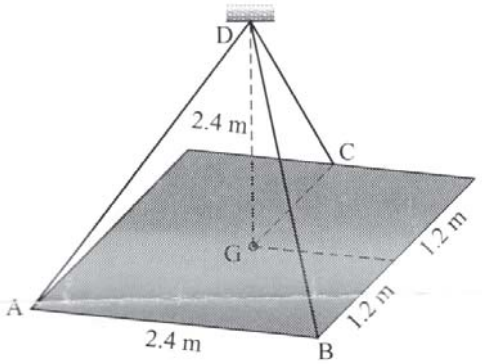


Fig. 2 b

c) Find support reaction at A and B for the beam AB as shown in Fig. 2 c.**[4]**

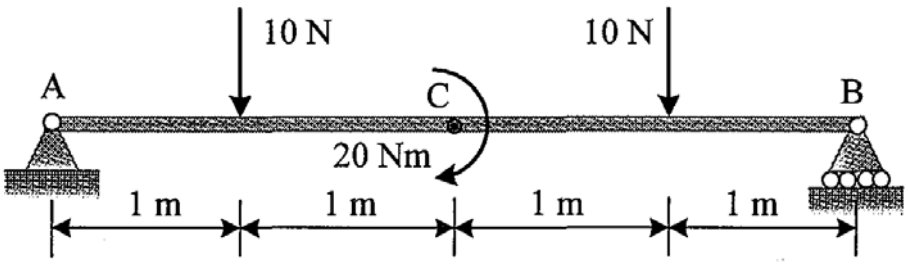


Fig. 2 c

Q3) a) Determine the forces in the members AB, AE and BE of the truss as shown in Fig. 3 a. **[7]**

b) The cable segment supports the loading as shown in Fig. 3 b. Determine the component of reactions at A and B. Also find maximum tension in segment of the cable. **[7]**

c) Differentiate truss and, frame with suitable sketch. **[4]**

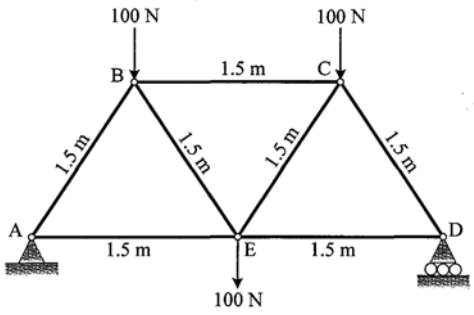


Fig. 3 a

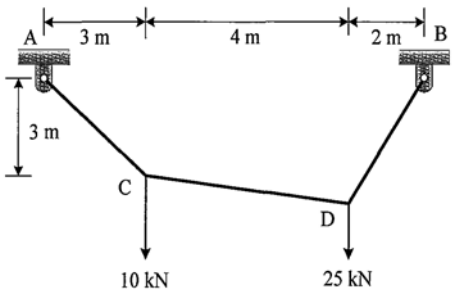


Fig. 3 b

OR

Q4) a) Determine the forces in the members BC, BE and AE of the truss as shown in Fig. 3 a. **[7]**

b) Determine the components of reactions at supports A and B for the frame loaded and supported as shown in Fig. 4 b. **[7]**

c) The maximum tension is 100 N for the Cable profiles ABCD as shown in Fig 4 c. Determine the force P at B and C to keep the segment BC in horizontal position. Also find tension in segment BC. **[4]**

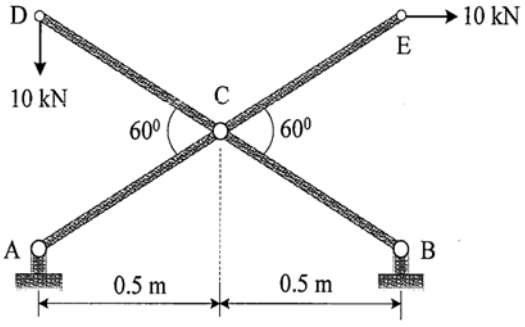


Fig. 4 b

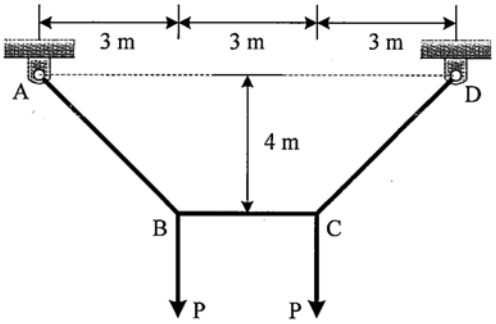


Fig. 4 c

Q5) a) A car comes to rest from an initial speed of 80 km/h in a distance of 30 m. With the same constant acceleration, determine the distance 's' for which the car comes to rest from an initial speed of 110 km/h. **[5]**

b) The truck travels at a speed of 4 m/s along a circular road that has a radius of 50 m. For a short distance from s = 0, its speed is then increased by $a_t = (0.05s)\ m/s^2$, where s is in meters. Determine the speed and magnitude of its acceleration when it has moved s = 10 m. **[6]**

c) A projectile is launched with a speed of V_0 = 25 m/s at an angle of θ = 30° with horizontal as shown in Fig. 5 c. Determine the maximum distance travel by projectile along horizontal and vertical direction. **[6]**

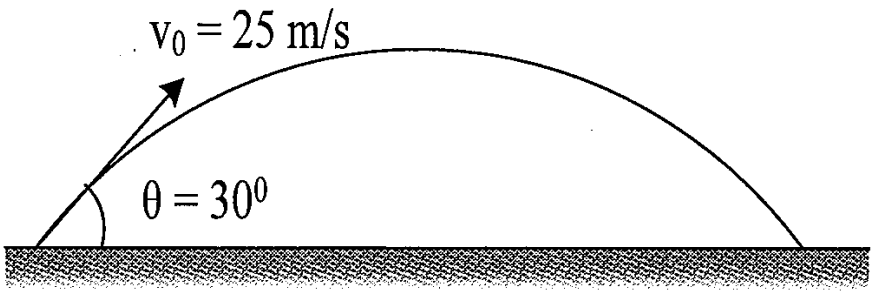


Fig 5 c

OR

Q6) a) The motion of a particle is defined by $x = 2t^3 - 15t^2 + 24t + 4$, where x is in m and t is in s. Determine when the velocity is zero and find position at which acceleration is zero. **[5]**

b) A motorist is traveling on a curve road of radius 760 m with 25 m/s. If he applies breaks to slow down to 20 m/s in 8 s. Determine the total acceleration of the vehicle at 20 m/s. **[6]**

c) A golfer hits the golf ball from point A with an initial velocity of 50 m/s at an angle of 25° with the horizontal shown in Fig. 6 c. Determine the maximum horizontal distance x_{max} and maximum height h_{max} it attain. **[6]**

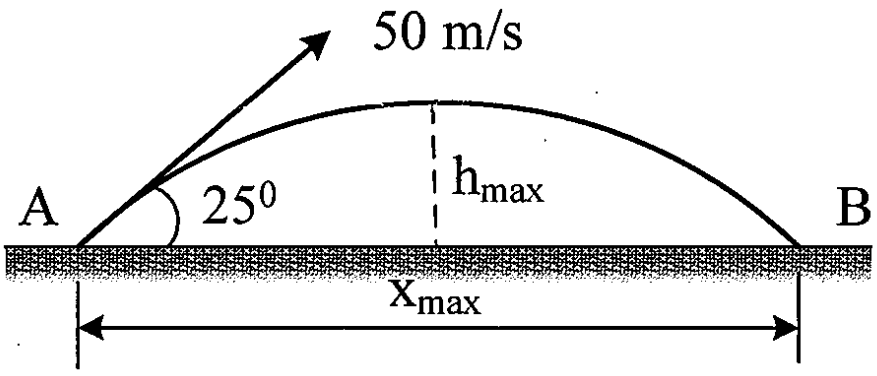


Fig. 6 c

Q7) a) The system shown in Fig. 7 a is initially at rest. Neglecting axle friction and mass of pulley, determine the acceleration of 200 kg block A. **[6]**

b) The pendulum bob has a mass m and is released from rest as shown in Fig. 7 b when $\theta = 0°$. Determine the tension in the cord as function of the angle of descent θ. Neglect the size of bob. **[6]**

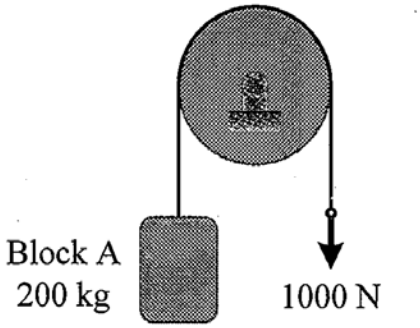


Fig. 7 a

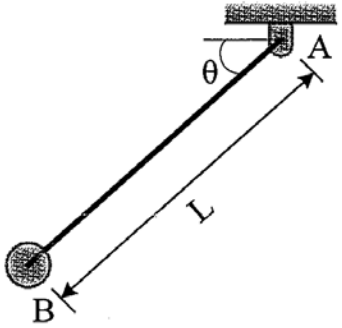


Fig. 7 b

c) A 20 Mg railroad car moving with 0.5 m/s speed to the right collides with a 35 Mg car which is at rest. If the coefficient of restitution between the two cars is e = 0.65 determine the speed of the cars after the collision.**[5]**

OR

Q8) a) A block of weight 200 N is kept on an incline plane and a force P = 200 N is applied to move the block as shown in Fig. 8 a. Determine the acceleration of the block, if coefficient of static and kinetic friction between block and plane are 0.3 and 0.25 respectively. **[5]**

b) The man has a mass of 80 kg and sits 3 m from the center of the rotating platform as shown in Fig. 8 b. Due to rotation his speed is increase from rest by $a_t = 0.4\ m/s^2$. If the coefficient of static friction between the clothes and the platform is $\mu_s = 0.3$, determine the time required to cause him to slip. **[6]**

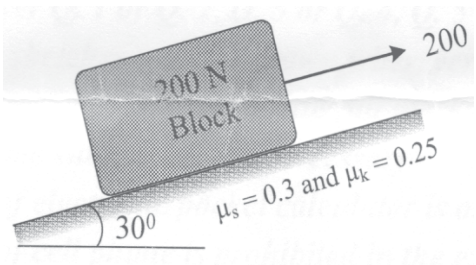


Fig. 8 a

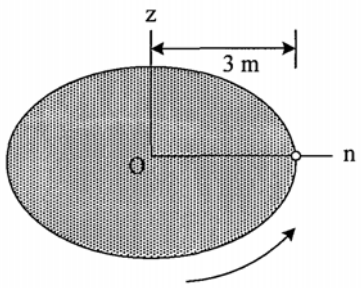


Fig. 8 b

c) A 2 kg pellet is released from rest at A and slides without friction along the surface as shown in Fig. 8 c. Using work energy principle find velocity at B. Also find the normal forces exerted by the surface on the pellet as it crosses point B. **[6]**

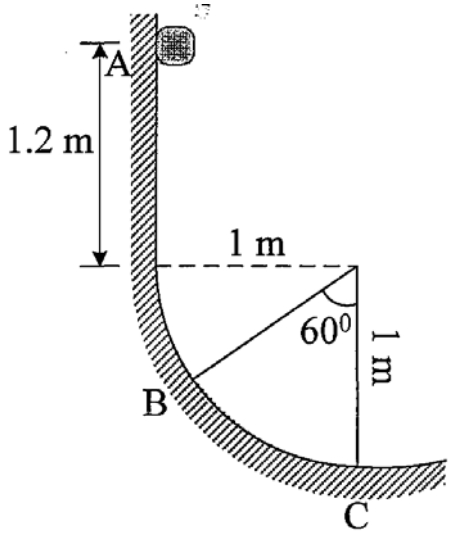


Fig. 8 c

Total No. of Questions : 8]

SEAT No. : ____

PB3593

[Total No. of Pages : 3

[6260]-8
F.E.
PROGRAMMING AND PROBLEM SOLVING
(2019 Pattern) (Credit System) (Semester - I/II) (110005)

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) ***Neat diagrams must be drawn weherver necessary.***
3) ***Assume suitable data wherever necessary.***

Q1) a) Write a short note on modules and package in python. **[6]**

b) Explain how we can pass command line arguments in python with a suitable example. **[6]**

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

OR

Q2) a) Write syntax of function definition and function call. Give a suitable example for the same. **[6]**

b) Explain the following types of function arguments with examples. **[6]**

i) variable length arguments

ii) default arguments

c) Write a program using lambda function to print a message ‘even’ if number is even and ‘odd’ if number is odd. **[5]**

Q3) a) Explain the following string operations with examples. **[6]**

i) concatenation

ii) appending

iii) string multiplication

b) Explain string formatting operator with suitable example. **[6]**

c) Write a program that finds whether a given character is present in a string or not. In case it is present it prints the index in which it is present. Do not use built-in find functions to search it. **[5]**

OR

P.T.O.

Q4) a) Explain string module in python. **[6]**

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

i) split()

ii) zfill()

iii) replace()

c) Write a program to reverse a string without using slicing operator. **[5]**

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

i) Procedural

ii) Structured

iii) Object Oriented

b) Differentiate between class variable and object variable. **[6]**

c) Write a program to create a class 'Book' with members, title, author, publisher, and ISBN number. The functions of the class should read and display the data. **[6]**

OR

Q6) a) Explain the following features of OOP **[6]**

i) Classes and Objects

ii) Methods and Message Passing

iii) Inheritance

b) Explain class methods with suitable example. **[6]**

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

Q7) a) What is a file? Explain different Access Modes. **[6]**

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

i) seek()

ii) writelines()

iii) readline()

c) Write a program that reads text from a file and writes in into another file but in the reverse order. (Hint: Make the first line in the original file as the last line in the copied file). **[6]**

OR

Q8) a) Explain the following method with suitable example **[6]**

i) getcwd()

ii) rmtree()

iii) makedirs()

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

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

i) fromkeys()

ii) setdefault()

iii) update()

Total No. of Questions : 9]

SEAT No. : ____

PB-3594

[Total No. of Pages : 4

[6260]-9
F.E. (All Branches)
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.No.9.***
3) ***Neat diagram must be drawn wherever 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 equations.

a) $\int_0^{\infty} e^{-x}\, x^{1/2}\, dx$ is equal to **[2]**

i) $\frac{1}{2}$ ii) $\frac{\sqrt{\pi}}{2}$

iii) $\frac{\pi}{2}$ iv) $\sqrt{\pi}$

b) $\int_0^{\pi/2} \cos^4 0 \; do$ is equal to **[2]**

i) $\frac{3\pi}{16}$ ii) $\frac{3\pi}{4}$

iii) 0 iv) $\frac{3\pi}{8}$

c) The region of absence for the curve represented by the equation $y^2(2a - x) = x^3$ is **[2]**

i) $x > 0, x < 2a$ ii) $x < 0, x > 2a$

iii) $x < 0, x < 2a$ iv) $x > 0, x > 2a$

P.T.O.

d) The centre and radius of sphere $x^2 + y^2 + z^2 - 2z - 3 = 0$ is **[2]**

i) (0, 0, 1) and 2 ii) (0, 0, 0) and 3

iii) (1, 0, 0) and 2 iv) (0, 0, –2) and 3

e) The value of $\int_0^1 \int_0^x dx\, dy$ is **[1]**

i) $\frac{1}{3}$ ii) $\frac{1}{3}x$

iii) $\frac{1}{2}$ iv) $\frac{1}{3}y$

f) $\int_0^1 x^{3/2}(1-x)^{5/2}\,dx$ is equal to **[1]**

i) $\beta(\frac{5}{2},\frac{7}{2})$ ii) $\beta(-\frac{1}{2},\frac{1}{2})$

iii) $\frac{1}{2}\beta(\frac{5}{2},\frac{3}{2})$ iv) $\beta(\frac{1}{2},\frac{5}{2})$

Q2) a) If $\text{In} = \int_{\pi/4}^{\pi/2} \cot^n\theta\, d\theta$, then prove that $\text{In} = \frac{1}{n-1} - \text{In}-2$. **[5]**

b) Evaluate $\int_0^\infty x^g e^{-2x^2} dx$. **[5]**

c) Show that $\int_a^b e^{-x^2} dx = \frac{\sqrt{\pi}}{2}[erf(b) - erf(a)]$. **[5]**

OR

Q3) a) If $\text{In} = \int_0^{\pi/2} x^n \cos x\, dx$, then show that $\text{In} = \left(\frac{\pi}{2}\right)^n - n(n-1)\,\text{In}-2$. **[5]**

b) Show that $\int_0^1 x^{m-1}(1-x^2)^{n-1} dx = \frac{1}{2}\beta\left(\frac{m}{2}1n\right)$. **[5]**

c) Evaluate $\int_0^1 \frac{x^a - x^b}{\log x} dx \;\; 0 < a < 1, 0 < b < 1$. **[5]**

Q4) a) Trace the curve $y^2(a - x) = x^3$. **[5]**

b) Trace the curve $r = \frac{a}{2}(1 + \cos\theta)$. **[5]**

c) Find the length of the upper arc of one loop of lemniscate $r^2 = a^2 \cos 2\theta$. **[5]**

OR

Q5) a) Trace the curve $xy^2 = a^2(a - x)$. **[5]**

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

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

Q6) a) Show that the plane $2x - 2y + z + 12 = 0$ touches the sphere $x^2 + y^2 + z^2 - 2x - 4y + 2z - 3 = 0$ and find the point of contact. **[5]**

b) Find the equation of right circular cone whose vertex is at (1, 2, –3), semi-vertical angle $\cos^{-1}\left(1/\sqrt{3}\right)$ & axis is the line $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z+1}{-1}$. **[5]**

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

OR

Q7) 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 point of contact. **[5]**

b) Find the equation of right circular cone which passes through the point (1, 1, 2) and has the axis as the line $6x = -3y = 4z$ and vertex at origin. **[5]**

c) Find the equation of right circular cylinder of radius 2, whose axis passes through (1, 2, 3) and has direction cosines proportional to 2, 1, 2. **[5]**

Q8) a) Evaluate $\iint_R x^2 y^2 dydx$ over positive quadrant of $x^2 + y^2 = 1$. **[5]**

b) Find the area between the curve $y = x^2 - 2x - 8$ and x – axis. **[5]**

c) Find the position of the centroid of the area bounded by the curve $y^2(2a - x) = x^3$ and its asymptote. **[5]**

OR

Q9) a) Change the order of integration $\int_0^2 \int_0^{2-x} y\, dy\, dx$ and then solve it. **[5]**

b) Evaluate $\iiint_V \frac{dxdydz}{\sqrt{1 - x^2 - y^2 - z^2}}$ taken throughout the volume of the sphere $x^2 + y^2 + z^2 = 1$ in the positive octant. **[5]**

c) Find the moment of inertia (M.I.) of the area enclosed by $r = a\,(1 - \cos\theta)$ about the line $\theta = \frac{\pi}{2}$. **[5]**

▽▽▽▽

Total No. of Questions : 8]

SEAT No. :

PB3595

[Total No. of Pages : 3

[6260]-10

FE.

ENGINEERING GRAPHICS - I

(2019 Pattern) (Semester - I/II) (102012) (Credit System)

Time : 2½ Hours] *[Max. Marks : 50*

Instructions to the candidate:

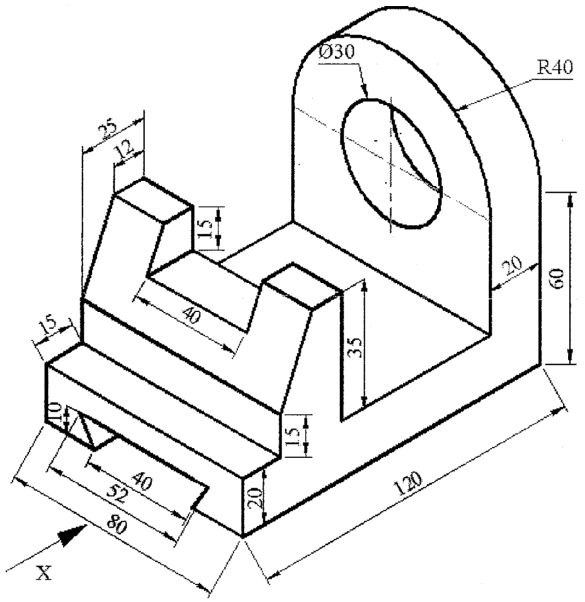
1) ***Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***State clearly the assumptions made, if any.***
4) ***Use of non-programmable calculator is allowed.***
5) ***Assume suitable data if necessary.***
6) ***Retain all the construction lines***

Q1) Draw an ellipse when the distance of focus from directrix is equal to 64 mm and eccentricity is 3/5. **[8]**

OR

Q2) Draw an involute of a circle having 50 mm diameter. **[8]**

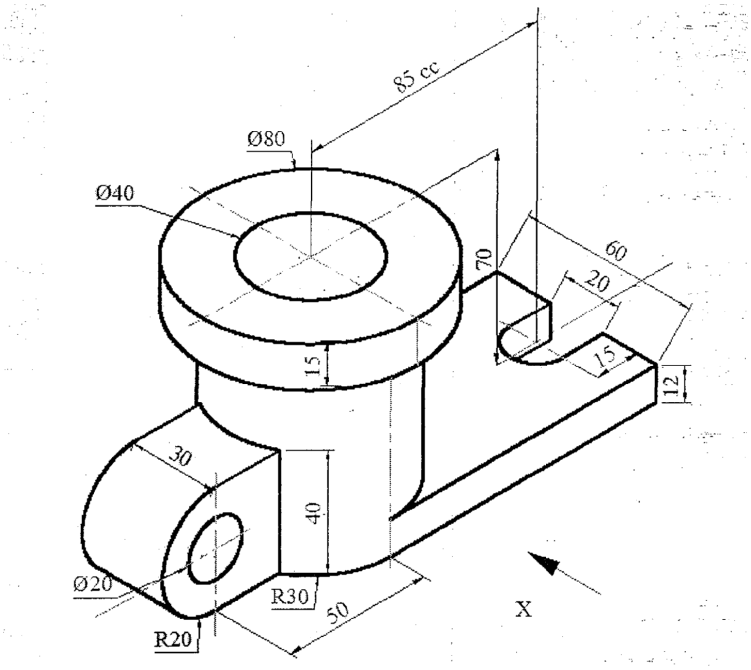
Q3) Figure shows a pictorial view of an object. By using first angle method of projection draw, front view looking in direction X, top view and side view. Give dimensions in all views. **[16]**



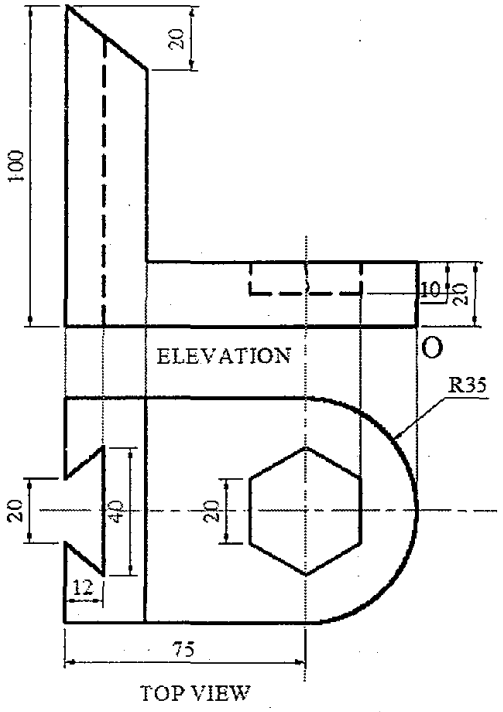
OR

P.T.O.

Q4) Figure shows a pictorial view of an object. By using first angle method of projection draw, sectional front view looking in direction X, section along line of symmetry, top view and side view. Give dimensions in all views. **[16]**

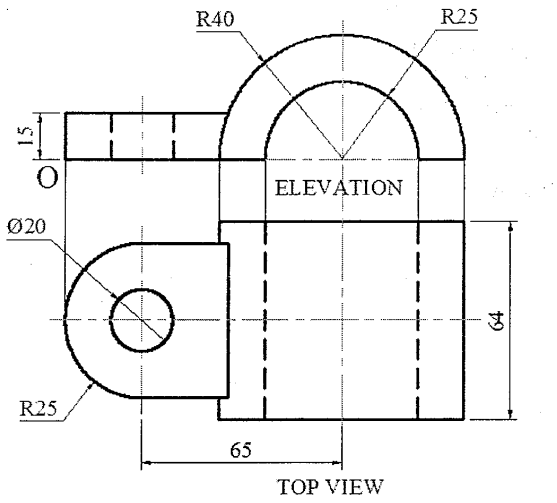


Q5) Figure shows front view and top view of an object. Draw isometric view. Give overall dimensions. **[16]**



OR

Q6) Figure shows front view and top view of an object. Draw isometric view. Give overall dimensions. **[16]**



Q7) A pentagonal pyramid, side of base edge 30 mm and height 60 mm, stands with its base on HP with an edge of base is parallel to VP and nearer to it. It is cut by a section plane perpendicular to VP, inclined at 45° to HP and passing through a point on axis, 32 mm above the base. Draw development of lower portion of the pyramid. **[10]**

OR

Q8) Draw the development of lower portion of pentagonal prism having side of base 35 mm and axis height 80 mm, rests on HP on its base with an edge of the base parallel to V.P., it is cut by a section plane inclined at 45° to HP and bisecting the axis of the prism. **[10]**