

SEAT No. :

[Total No. of Pages : 4

[Max. Marks : 70]

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

i) If $u = \frac{1}{x^2 + y^2}$ then $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \dots$ [2]

- a) 0 b) $-2u$
c) $2u$ d) none

ii) If $x = uv, y = \frac{u}{v}$ then $\frac{\partial(x, y)}{\partial(u, v)} = \dots\dots\dots$ [2]

- a) $-\frac{2u}{v}$ b) uv
- c) $\frac{v}{2u}$ d) $-\frac{v}{2u}$

iii) Rank of a matrix $A = \begin{bmatrix} 2 & 2 & 2 \\ 0 & -2 & 0 \\ 2 & 2 & 2 \end{bmatrix}$ is

- a) 0 b) 1
c) 2 d) 3

iv) For the matrix $A = \begin{bmatrix} 1 & 0 & 0 \\ -1 & 2 & 0 \\ 1 & 0 & 3 \end{bmatrix}$ the eigenvalues of A^2 are

- a) 1,2,3 b) 1,4,9
c) -1, -2, -3 d) -1, -4, -9

P.T.O.

v) If $z = xy$ then $\frac{\partial^2 z}{\partial x \partial y} = \dots$ [1]

- a) x
c) 1
- b) y
d) 0

vi) If $A^{-1} = A^T$ then matrix A is _____ [1]

- a) Singular b) Non-singular
c) Orthogonal d) None

Q2) a) If $u = \tan^{-1}\left(\frac{x}{y}\right)$, then show that $u_{xy} = u_{yx}$. [5]

b) If $u = \ln(x) + \ln(y)$, find the value of $x^2 u_{xx} + 2xy u_{xy} + y^2 u_{yy} + xu_x + yu_y$. [5]

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

OR

Q3) a) If $ux + vy = 0$ and $\frac{u}{x} + \frac{v}{y} = 1$, then show that $\left(\frac{\partial u}{\partial x}\right)_y - \left(\frac{\partial v}{\partial y}\right)_x = \frac{x^2 + y^2}{y^2 - x^2}$ [5]

b) If $f(x, y) = x^2 + (x^2 + y^2)[\ln(x) - \ln(y)]$, then find the value of $xf'_x + yf'_y$ [5]

c) If $x = u + v + w$, $y = uv + vw + wu$, $z = uvw$ and F is a function of x, y, z show that $uF_u + vF_v + wF_w = xF_x + 2yF_y + 3zF_z$. [5]

Q4) a) If $x = r \cos \theta$, $y = r \sin \theta$, then find $\frac{\partial(r, \theta)}{\partial(x, y)}$ [5]

b) Examine for functional dependence : [5]

$u = \frac{x-y}{x+y}$, $v = \frac{x+y}{x}$. If functionally dependent find the relation between them.

c) Discuss maxima and minima of $f(x,y) = x^2 + y^2 + 6x + 12$. [5]

OR

Q5) a) Verify $JJ' = 1$ for the transformation $x = uv$, $y = \frac{u}{v}$. [5]

b) In calculating the volume of a right circular cone, errors of 2% and 1% are made in measuring the height and radius of base respectively. Find the error in the calculated volume. [5]

c) By using Lagrange's method, divide 24 into three parts such that the continued product of the first, square of the second and cube of the third is maximum. [5]

Q6) a) Show that the system [5]

$$3x + 4y + 5z = \alpha$$

$$4x + 5y + 6z = \beta$$

$$5x + 6y + 7z = \gamma$$

is consistent only when α, β, γ are in arithmetic progression.

b) Examine for linear dependence or independence, if dependent find the relation between them. $X_1 = (1, 1, 1, 3)$, $X_2 = (1, 2, 3, 4)$, $X_3 = (2, 3, 4, 7)$ [5]

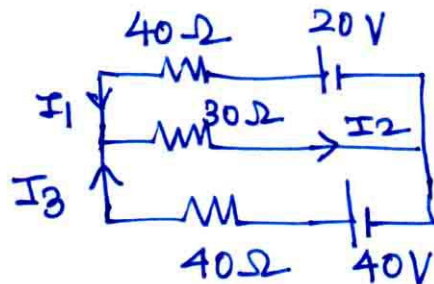
c) If $A = \begin{bmatrix} \frac{1}{3} & \frac{2}{3} & a \\ \frac{2}{3} & \frac{1}{3} & b \\ \frac{2}{3} & \frac{-2}{3} & c \end{bmatrix}$ is orthogonal. Find a, b, c. [5]

OR

Q7) a) Examine the consistency of the linear system of the following equations. If consistent solve it $x + y + z = 3$, $x + 2y + 3z = 4$, $x + 4y + 9z = 6$. [5]

b) Examine for linear dependence or independence of the following vectors. If dependent, Find the relation among vectors $(1, 1, 1)$ $(1, 2, 3)$ $(2, 3, 8)$. [5]

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



Q8) a) Find eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 1 & 1 & -2 \\ -1 & 2 & 1 \\ 0 & 1 & -1 \end{bmatrix}$. [5]

b) Verify the Cayley Hamilton theorem for $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & -2 \\ -2 & 0 & 1 \end{bmatrix}$ and use it to

find A^{-1} . [5]

c) Find the modal matrix p such that $p^{-1}AP$ is diagonal matrix for

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

OR

Q9) a) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$. [5]

b) Reduce the following quadratic form to the "sum of the squares form"
 $2x^2 + 9y^2 + 6z^2 + 8xy + 8yz + 6xz$. [5]

c) Verify the Cayley Hamilton theorem for $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -3 \end{bmatrix}$ Hence find A^{-1} . [5]



Total No. of Questions : 9]

SEAT No. :

PD4025

[Total No. of Pages : 4

[6401]-1902

F.E.

ENGINEERING PHYSICS

(2019 Pattern) (Credit System) (Semester - I/II) (107002)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

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) Planck's constant = $h = 6.63 \times 10^{-34}$ J.S

Q1) Write correct option of given questions with answer (one mark each) **[10]**

- a) The matter waves would be associated with _____ moving with speed comparable to the speed of light.
 - i) Electron
 - ii) Proton
 - iii) Neutron
 - iv) All of the above
- b) De Broglie hypothesis is applicable for
 - i) Matter particles
 - ii) Electromagnetic waves
 - iii) Mechanical waves
 - iv) None of the above
- c) Heisenberg's uncertainty principle is about the _____ of position and momentum of a particle.
 - i) Difference
 - ii) Addition
 - iii) Multiplication
 - iv) Division
- d) Which of the following represent correct ordering for band gap energy?
 - i) Metal > Semiconductor > Insulator
 - ii) Metal < Semiconductor < Insulator
 - iii) Metal < Semiconductor > Insulator
 - iv) Metal > Semiconductor < Insulator

P.T.O.

- e) Hall effect is true for
- Metals only
 - P-type semiconductors only
 - N type semiconductors
 - All of the above
- f) The relation between magnetic field strength (H), magnetization(M) and susceptibility(X) is
- $X = M/H$
 - $X = M + H$
 - $X = M \times H$
 - $X = H/M$
- g) The magnetism produced in an atom is because of
- Orbital motion of electron
 - Spin motion of electron
 - Spin motion of nucleus
 - Combined effect of a, b, c
- h) Below critical temperature, resistance of superconductor is _____ and it has _____ conductivity.
- Infinite, zero
 - Unity, Unity
 - Zero, Infinite
 - Infinite, infinite
- i) _____ are performed to estimate internal defects in the materials.
- Destructive testing
 - Non-Destructive testing
 - Both (i) & (ii)
 - None of (i) and (ii)
- j) Nanomaterials has at least one dimension in the range.
- 1 to 100 nm
 - 100 to 1000 nm
 - 1 to 10 μm
 - Greater than 10 μm

- Q2)** a) Derive the expression for the energy of a particle enclosed in an infinite potential well. [6]
- b) State and explain Heisenberg's uncertainty principle. [5]
- c) Calculate wavelength of matter waves associated with an electron having energy 10eV. [4]

OR

- Q3)** a) Derive schrodinger's time independent equation. [6]
- b) State and explain de Broglie hypothesis of matter waves. Write any two properties of matter waves. [5]
- c) Calculate minimum energy associated with an electron enclosed in a potential well of length 2AV. [4]

- Q4)** a) With a suitable diagram. Explain Hall effect. Derive expression for Hall Voltage. [6]
- b) Define efficiency of solar cell. State any four measures to improve efficiency of solar cells. [5]
- c) Calculate number of acceptor atoms that are required to be added to an intrinsic silicon to achieve a resistivity of 10 ohm-cm. [Given - mobility of holes $500\text{cm}^2/\text{V.S}$] [4]

OR

- Q5)** a) Derive the expression for conductivity of intrinsic and extrinsic semiconductors. [6]
- b) Define Fermi level in conductor. Using Fermi-Dirac distribution function. Calculate the probability of finding electrons at $T = 0\text{ K}$ for energy levels. [5]
- i) $E < E_f$
- ii) $E > E_f$
- c) A strip of copper of thickness $1.5 \times 10^{-4}\text{ m}$ is placed in a magnetic field of 1T acting along its thickness; A current of 10A is setup along its length. The voltage developed across width is $5\mu\text{V}$. Calculate concentration of charge carriers. [4]

- Q6)** a) Explain how the information is recorded and retrieved (read) in magnetic storage devices. [6]
- b) Explain in brief :
- i) Magnetic field strength (H)
- ii) Magnetization (M)

Write relation between them.

- c) The critical temperature for lead is $T_c = 7.18\text{K}$, critical magnetic field at 0 K, $H_c(0) = 6.5 \times 10^4\text{ A/M}$. Calculate critical magnetic field $H_c(T)$ at $T = 4.2\text{K}$. [4]

OR

- Q7)** a) State and explain meissner effect. Show that super conductors are perfect diamagnetic. [6]
- b) Define critical magnetic field. Differentiate between type I & type II super conductors. (Any two points). [5]
- c) Explain in brief : [4]
- i) Magnetic induction (B)
- ii) Magnetic permeability (μ)
- Q8)** a) Explain with a suitable diagram, how ultrasonic testing technique is used for flow defection. [6]
- b) What is Non Destructive Testing (NDT)? Write advantages of Non Destructive Testing over destructive testing (any four). [5]
- c) Explain applications of nanotechnology in medicine (targeted drug delivery). [4]

OR

- Q9)** a) Explain optical and electrical properties of nano particles. [6]
- b) What is nanotechnology? Explain why properties of nanoparticles are different than corresponding bulk materials. [5]
- c) A block of metal has a thickness of 0.5 cm. An ultrasonic pulse of velocity 5000 m/s is sent through the top of the block. After what time echo would be received from the bottom of the block. At some other location in the block. Echo is received from. Flow after $1.5\mu\text{s}$. Calculate location of the flow. [4]



Total No. of Questions : 8]

SEAT No. :

PD4026

[Total No. of Pages : 2

[6401]-1903

F.E.

**SYSTEMS IN MECHANICAL ENGINEERING
(2019 Pattern) (Credit System) (Semester -I/II) (102003)**

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) Assume suitable data if necessary.
- 3) Figures to the right indicate full marks.

Q1) a) Explain Hybrid Vehicle with neat diagram. **[10]**

b) Classify Automobile and Compare specification of two wheeler and LMV. **[8]**

OR

Q2) a) Classify Automobile and Compare specification of LMV and Heavy Motor Vehicle (HMV) **[10]**

b) Explain Electric Vehicle with neat diagram. **[8]**

Q3) a) Write a short note on Active safety and Passive safety in vehicles. **[10]**

b) Explain steering system with neat diagram. **[7]**

OR

Q4) a) Explain single plate clutch with neat diagram. **[10]**

b) Explain antilock braking system in vehicle with neat diagram. **[7]**

Q5) a) Explain with neat sketch the sand casting process. State its advantages and disadvantages. **[10]**

b) Explain water cooling system used in vehicle with neat diagram. **[8]**

OR

P.T.O.

Q6) a) Explain with neat sketch the forging process. State its advantages and disadvantages. **[10]**

b) Explain shielded metal arc welding process with labeled sketch. **[8]**

Q7) a) Explain with neat sketch electric arc welding. **[10]**

b) Write a short note on IOT. **[7]**

OR

Q8) a) Explain with neat sketch the working of water purifier. **[10]**

b) Explain the working of kitchen chimney. **[7]**

* * *

Total No. of Questions : 9]

SEAT No. :

PD4027

[6401]-1904

[Total No. of Pages : 4

F.E.

ENGINEERING CHEMISTRY

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

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Attempt 2 or 3, 4 or 5 6 or 7 & 8 or 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: [10]

- a) Poly Phenylene Vinylene (PPV) shows the property of.
 - i) Bioluminescence
 - ii) Luminescence
 - iii) Chemiluminescence
 - iv) Electroluminescence
- b) P-doping of conducting polymer is done by
 - i) I_2
 - ii) Na
 - iii) Li
 - iv) $SnCl_2$
- c) Nanomaterials are the materials in which size of particles ranges from
 - i) 1 nm - 100 nm
 - ii) 1 cm - 100 cm
 - iii) 1 mm - 100 mm
 - iv) 1 m - 100 m
- d) Catalyst used in shift reaction of H_2 production is
 - i) FeO
 - ii) Ni
 - iii) CH_3ONa
 - iv) None of these
- e) The relation between Gross and Net calorific value is
 - i) $GCV = NCV$
 - ii) $GCV > NCV$
 - iii) $GCV < NCV$
 - iv) None of these
- f) The detector used in UV-Visible spectrophotometer is
 - i) Phototube
 - ii) Photomultiplier tube
 - iii) Photovoltaic cell
 - iv) All of these

P.T.O.

- g) If absorption of molecule is shifted to wards longer wave length due to solvent effect is called as
- i) Hypsochromic shift ii) Hypochromic shift
 - iii) Bathochromic shift iv) Hyperchromic shift
- h) Bending vibrations are characterised by
- i) Change in bond angle between two covalent bonds
 - ii) Change in bond lenght between two covalent bonds
 - iii) Change in geometry of molecule
 - iv) No any change
- i) Galvanising is coating of
- i) Fe on Sn ii) Zn on Fe
 - iii) Sn on Fe iv) Fe on Zn
- j) Which type of reaction occur in anodic areas
- i) Oxidation ii) Reduction
 - iii) Displacement iv) Addition

- Q2) a)** What are Biodegradable polymers? Give the structure of PHBV. Explain three factors responsible for biodegradation. Give its any two applications. **[6]**
- b) What are carbon nanotubes? Discuss the different types of carbon nanotubes with respect to their structure. Give any two applications. **[5]**
- c) Give the structure, any two properties and two applications of polycarbonate. **[4]**

OR

- Q3) a)** Explain the structure of Graphene with the help of diagram and mention three properties and three applications. **[6]**
- b) Define polymer composites. What is the role of matrix phase and disperse phase in composites. Give any two advantages. **[5]**
- c) What are nanomaterials. Classify any three on the basis of dimensions. **[4]**

- Q4)** a) Give construction with figure, working and give corrected formula for finding gross calorific value of a solid fuel by Bomb calorimeter. [6]
 b) Give the preparation on reaction of Biodiesel. State three advantages of biodiesel. [5]
 c) 1.5 gm of coal sample in kjeldhal's experiment, librated ammonia which was absorbed in 25/ml 0.1N H_2SO_4 . The resultant solution required 14ml of 0.1N NaOH for complete neutralisation of H_2SO_4 . In back titration. The reading of blank titration was 25ml. Find the percent of nitrogen in coal. [4]

OR

- Q5)** a) Explain in brief the process with diagram for distillation of crude petroleum. Give composition, boiling range and uses of any two fractions obtained. [6]
 b) What is Power alcohol? Give any three merits and three demerits of power alcohol. [5]
 c) The following data was obtained in Boy's Jas calorimeter experiment. [4]
 i) Volume of gas burat at STP = $0.12m^3$
 ii) Mass of cooling water = 32kg
 iii) Rise in temperature of water = $7.8^\circ C$
 iv) Mass of steam condensed = 0.09kg
 Calculate GCV and NCV of the fuel

- Q6)** a) Draw the block diagram of IR spectrophotometer. Explain its four components and give their function. [6]
 b) Explain the possible electronic transitions that occure in the molecule after absorption of UV radiations with suitable examples and labelled diagram. [5]
 c) Explain any four applications of UV-Visible spectroscopy. [4]

OR

- Q7)** a) i) State and give mathematical expression of Beers and Lambert's law of absorption. [4]
 ii) Define- [2]
 1) Auxochrome
 2) Hypsochromic shift
 b) What are the conditions of IR radiations by the molecule? Explain the fundamental modes of streching vibrations. [5]
 c) Give the principle of IR spectroscopy. Calculate the fundamental modes of vibrations for the following molecules. [4]
 i) NO
 ii) H_2O
 iii) C_2H_6

- Q8)** a) State Pilling Bedworth ratio and give its significance. Give the different types of oxide films with suitable example formed during the oxidation corrosion of metals. **[6]**
- b) What is principle of cathodic protection? Explain the method involved using sacrificial anode and give its two applications. **[5]**
- c) What are anodic and cathodic coatings? Which one is more protective and why? **[4]**

OR

- Q9)** a) Explain the mechanism of wet corrosion by hydrogen evolution and oxygen absorption with diagram and reactions. **[6]**
- b) Explain any five factors affecting the rate of corrosion related to metal. **[5]**
- c) Define electroplating. Give the electroplating reactions with respect to the metals like Ag, Ni and Cr. **[4]**



Total No. of Questions : 8]

SEAT No. :

PD4028

[Total No. of Pages : 4

[6401]-1905

First Year Engineering (All Branches)

BASIC ELECTRICAL ENGINEERING

(2019 Pattern) (Credit System) (Semester - I/II) (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) 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-programmable calculator is allowed.

Q1) a) For the Resonance in RLC Series circuit-Comment on reactance's, impedance, current & power factor. **[4]**

b) The R-L circuit when supplied by 180V, 50 Hz ac voltage, the voltage drop across the inductance is 150 V. The current drawn by the circuit is 5 A. Calculate: **[6]**

- i) Inductive Reactance
- ii) Inductance
- iii) Resistance
- iv) Impedance
- v) Voltage across Resistance and
- vi) P.F.

c) A voltage of $V = V \angle 0^\circ$ is applied across a R-L-C series circuit. Write the equation for impedance, current & comment on power factor --- when **[8]**

- i) $X_L > X_C$
- ii) $X_L < X_C$

Also draw the phasor diagram in each case.

OR

P.T.O.

- Q2) a)** Define and state the unit of **[4]**
- i) Admittance, susceptance, & conductance
 - ii) Impedance
- b) If $v = V_m \sin(\omega t)$ is applied across single phase circuit and current flowing through the circuit is $i = I_m \sin\left(\omega t + \frac{\pi}{2}\right)$. Draw the circuit diagram & derive the expression for average power consumed in the circuit. **[6]**
- c) A Pure resistance of 15Ω is connected in series with a pure inductor of 25mH. This series circuit is connected across 230V, 50-Hz supply. Find **[8]**
- i) The Inductive Reactance
 - ii) Impedance
 - iii) Current
 - iv) Power factor
 - v) Phase angle
 - vi) Voltage across Resistor
 - vii) Voltage across inductor
 - viii) Draw the phasor diagram
- Q3) a)** State the advantages of three phase systems over single phase system. **[3]**
- b) Derive the EMF Equation of single-phase transformer. **[6]**
- c) In a 3-phase Star-connected load, each phase has a an impedance of $(50+j32)\Omega$. This load is fed from three phase supply voltage of 400 V with frequency of 50Hz. Calculate: **[8]**
- i) Phase Voltage and Line Voltage;
 - ii) Phase Current and Line Current;
 - iii) Total Active Power, Reactive Power and Apparent Power consumed.

OR

- Q4) a)** State the different types of losses in the transformer. [3]
- b)** A 80 KVA, 3200/400V, 50Hz, single phase transformer has 111 turns on the secondary winding. Calculate [6]
- Number of turns on primary side
 - Primary & Secondary full load current
 - Cross sectional area of the core if the maximum flux density is 1.2T
- c)** Derive the relationship between the line current and phase current, line voltage and phase voltage, for a balanced three phase STAR connected load across three phase AC supply. Draw the circuit diagram & required phasor diagram. Assume phase sequence RYB and inductive load. [8]

- Q5) a)** Compare the ideal & practical voltage source by means of [4]
- definition
 - Symbol & V-I characteristics.
- b)** Write the three steps to find current flowing through load resistance R_L using Thevenins Theorem for the circuit shown in Figure-5 (b). [6]

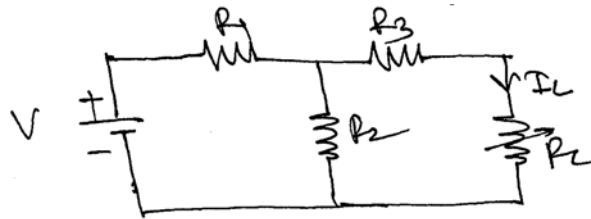


Figure-5 (b)

- c)** Derive the formulae to convert DELTA connected resistances into equivalent STAR connected resistances. Draw the circuit diagram in each case. [8]

OR

- Q6) a)** State and Explain Kirchhoffs Laws. [4]
- b)** Find the Resistance between terminal A and C. [6]

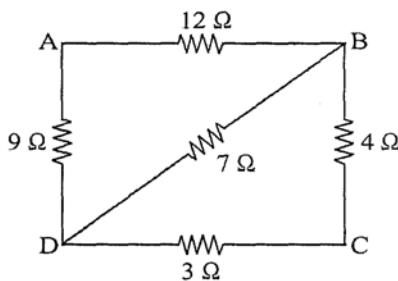


Figure-6 (b)

- c) Find the current flowing through $5\ \Omega$ by applying Super Position Theorem. [8]

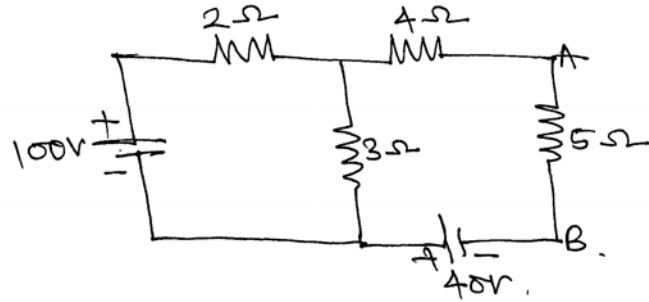


Figure 6 (c)

- Q7) a)** Comment on effect of increase in temperature on Resistance of [3]

- i) metallic conductor
- ii) alloys &
- iii) insulators

- b) Explain the construction and working of Lead acid battery. [6]

- c) Derive the expression of insulation resistance of the single core cable. Draw the cut section diagram & label it. [8]

OR

- Q8) a)** State the 3 applications of lithium ion battery. [3]

- b) With usual notations derive the expression [6]

$$\alpha_2 = \frac{\alpha_1}{1 + \alpha_1(t_2 - t_1)}$$

- c) Find the current flowing at the instant of switching 40 W , 240 V filament lamp. The temperature coefficient of resistance of filament is 5.5×10^{-3} .per degree Celsius at 20°C . The working temperature of lamp is 2000°C . Also find the working current & compare it with starting current. [8]

x x x

Total No. of Questions : 8]

SEAT No. :

PD4029

[Total No. of Pages : 2

[6401]-1906

F.E.

BASIC ELECTRONICS ENGINEERING

(2019 Pattern) (Credit System) (Semester - I/II) (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) Assume suitable data, if necessary.

Q1) a) Convert [6]

- i) $(10100.1011)_2$ to Decimal
- ii) $(832.24)_{10}$ to Hexadecimal
- iii) $(556.27)_8$ to Hexadecimal
- iv) $(2C6.1B)_{16}$ to Octal
- v) $(D43A.03)_{16}$ to Decimal
- b) Define Universal Logic Gates. Why they known as Universal Logic Gates?[6]
- c) Compare Microprocessor and Microcontroller. [6]

OR

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

- b) Explain in detail the working of a full adder with the help of a truth table, logic equations and diagram. [6]
- c) Explain different types of flip-flops and state one application of each.[6]

Q3) a) Explain Digital Multimeter with block diagram. [6]

- b) Explain Digital Storage Oscilloscope with block diagram. [6]
- c) Explain Auto Transformer and list its applications. [5]

OR

P.T.O.

- Q4)** a) Explain Function Generator with block diagram. [6]
b) Explain working of DC Power Supply with block diagram and waveforms. [6]
c) Explain how to convert Galvanometer to Analog Ammeter and how to use it as multi-range Ammeter? [5]

- Q5)** a) With the help of diagram, explain operation of LVDT. Write its advantages, disadvantages and applications. [6]
b) Explain RTD with its construction, working, advantages, disadvantages and applications. [6]
c) Explain working principle of strain gauge. Explain load cell. [5]

OR

- Q6)** a) Explain selection criteria of transducers. [6]
b) Explain Thermocouple with its construction, working, advantages, disadvantages and applications. [6]
c) Explain operation of Bio-sensor with one application. [5]

- Q7)** a) With the help of block diagram, explain basic communication system. [6]
b) Draw Block Diagram of AM Transmitter and explain. [6]
c) Draw diagram explain GSM architecture. [6]

OR

- Q8)** a) Explain need of modulation. What are the different techniques of modulation. [6]
b) Explain IEEE electromagnetic frequency spectrum and state allotment of frequency bands for different applications. [6]
c) Explain cellular communication system. [6]



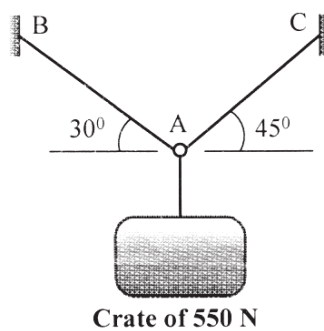
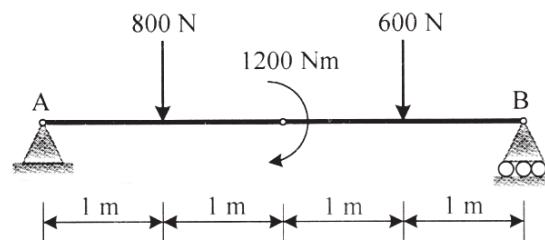
[6401]-1907

F.E.

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 and 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) State and explain free body diagram with suitable sketch. [4]
- b) Determine the force in cable AB and AC as shown in Fig. 1 b, if the weight of crate is 550 N. [7]
- c) Determine the support reaction for a given beam loaded and supported as shown in Fig. 1 c. [7]

**Fig. 1 b****Fig. 1 c**

OR

- Q2)** a) State and explain in brief resultant and equilibrant force. [4]
- b) A 3 m wooden beam weighing 540 N is supported as shown in Fig. 2 b. Find the reaction at A and tension in cable BC. [7]

- c) Determine the resultant force of given parallel space force system as shown in Fig. 2 c. Also locate the position of resultant force with respect to origin O. [7]

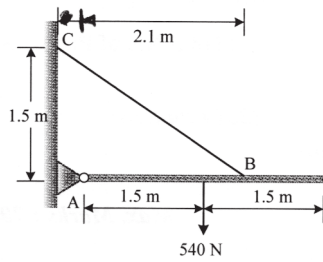


Fig. 2 b

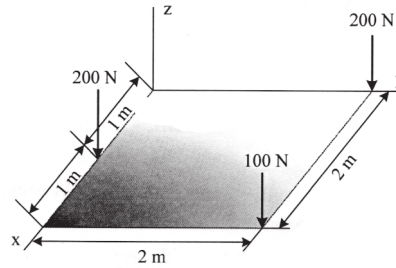


Fig. 2 c

- Q3) a) Differentiate pin jointed truss and cable with suitable sketch. [4]
 b) Determine the forces in the members of the pin jointed truss as shown in Fig. 3 b. [7]
 c) The cable segment supports the loading as shown in Fig. 3 c. Determine the component of reactions at A and B. Also find maximum tension in segment of the cable. [7]

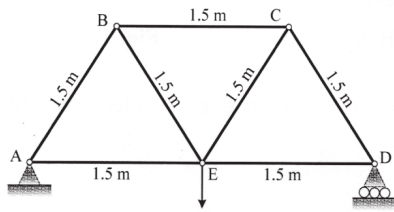


Fig. 3 b

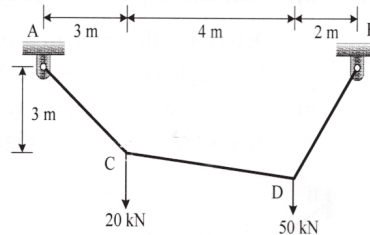


Fig. 3 c

OR

- Q4) a) Explain deficient, determinate and indeterminate truss. [4]
 b) The maximum tension is 100 N for the Cable profiles ABCD as shown in Fig 4 b. Determine the force P at B and C to keep the segment BC in horizontal position. [7]

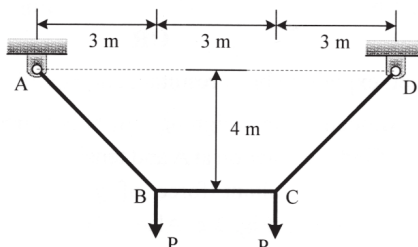


Fig. 4 b

- c) Determine the forces in the members BC, BE and AE of the truss as shown in Fig. 3 b. [7]

- Q5) a)** The motion of particle is defined by $x = t^3 - 6t^2 + 9t + 5$, where x is in meter and t in seconds. Find the time at which velocity is Zero. Also determine velocity and acceleration at $t = 5$ s. [5]
- b)** An outdoor track is 126 m in diameter. A runner increases her speed at a constant rate from 4.2 m/s to 7.2 m/s over a distance of 28.5 m. determine the total acceleration of the runner 2s after she begins to increase her speed. [6]
- c)** A cricket ball thrown by a fielder from a height of 2 m at an angle of 45° to the horizontal with an initial velocity of 25 m/s hit the wickets at the height of 0.6 m from the ground, find distance of fielder from the wickets. [6]

OR

- Q6) a)** A baseball is thrown downward from a 15 m tower with an initial speed of 5 m/s. Determine the speed at which it hits the ground and the time of travel. [5]
- b)** A particle moves in a circular path of radius 0.4 m. Calculate magnitude of acceleration of the particle if its speed is 0.6 m/s and it increasing at the rate of $a_t = 1.2 \text{ m/s}^2$. [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]

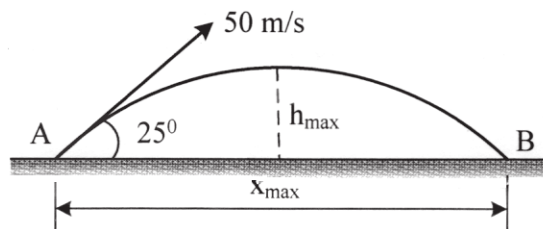


Fig. 6 c

- Q7) a)** A 150 kg car enters a curved portion of the road of radius 200 m travelling at a constant speed of 36 km/h. Determine the normal and tangential component of force at curved portion. [5]
- b)** A 2 kg stone is dropped from a height h and strike the ground with a velocity of 24 m/s. find the kinetic energy of the stone as it strikes the ground and the height h from which it was dropped using work energy method. [6]
- c)** A railroad car having a mass of 15 Mg is coasting at 1.5 m/s on a horizontal track. At the same time another car having a mass of 12 Mg is coasting at 0.75 m/s in the opposite direction. If the car meet and couple together, find the common speed of cars. [6]

OR

- Q8)** a) A tennis ball is dropped from a height 1600 mm and it rebounds to a height 1100 mm. Determine the coefficient of restitution. [5]
- b) A 50 kg crate shown in Fig. 8 b rests on a horizontal plane for which the coefficient of kinetic friction is $\mu_k = 0.3$. If the crate does not tip over when it is subjected to a 400 N towing force as shown, determine the velocity of the crate in 5 s starting from rest. [6]
- c) Determine the work done by all forces acting on the block of 18 kg as shown in Fig. 8 c as it moves 12 m upwards along the plane. Take coefficient of kinetic friction $\mu_k = 0.2$. [6]

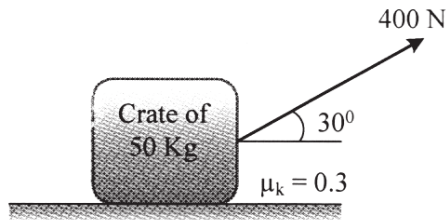


Fig. 8 b

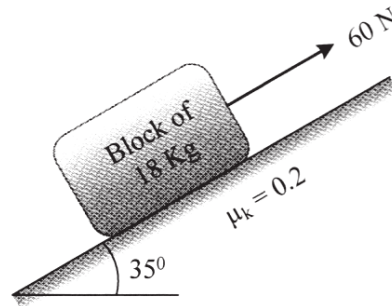


Fig. 8 c



Total No. of Questions : 8]

SEAT No. :

PD-4031

[Total No. of Pages : 3

[6401]-1908

F.E.

PROGRAMMING AND PROBLEM SOLVING

(2019 Pattern) (Semester - II) (110005)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Neat Diagrams must be wherever necessary.*
- 3) *Assume suitable data wherever necessary.*

Q1) a) Define a function with suitable function? Explain need for a function. [6]

b) Differentiate between local and global variables. [6]

c) Write a program using function to find largest of 3 numbers by passing numbers as arguments. [5]

OR

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

i) default arguments

ii) variable length arguments

b) What are the modules and packages in python? Explain user defined module with suitable example. [6]

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

Q3) a) Explain different ways of iterating a string. [6]

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

i) ord() and chr() function

ii) in and not in operators on string

P.T.O.

- c) What is the output of the following statement for the given string?
S = "Learning Python is fun" [5]
- i) print(S[:10])
 - ii) print(S[::-1])
 - iii) print("Is" not in S)
 - iv) print(S[4])
 - v) print(S[0:10])

OR

- Q4)** a) Explain different ways of formatting a string. [6]
- b) Explain following string methods with example. [6]
- i) isspace()
 - ii) join()
 - iii) lower()
- c) Write a program to display a string and count characters in the string using a loop. [5]

- Q5)** a) What is programming paradigm? Explain the following Programming Paradigms in detail [6]
- i) Monolithic Programming
 - ii) Procedural Programming
- b) Explain the following concepts with example. [6]
- i) Object variable
 - ii) Class variable
- c) Write a python program to create a class Employee with the attributes Name, emp_id, and salary and display data of 4 employees. [6]

OR

- Q6)** a) Explain the following features : [6]
- i) Containership
 - ii) Inheritance
 - iii) Data Abstraction
- b) Explain class method and self-object with suitable example. [6]
- c) Write a program to create class Car with two attributes name and cost. Create two objects and display information. [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) read(n)
 - ii) readlines()
 - iii) close()
- c) Explain the following file access modes [6]
- i) r
 - ii) w+
 - iii) ab+
 - iv) rb
 - v) a
 - vi) a+

OR

- Q8)** a) Explain any 3 directory methods with example. [6]
- b) Explain text and binary files with example. [6]
- c) Explain any 3 dictionary methods with example. [6]



Total No. of Questions : 9]

SEAT No. :

PD4032

[6401]-1909

[Total No. of Pages : 4

F.E.

ENGINEERING MATHEMATICS - II

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

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Q.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 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) Write the correct option for the following multiple choice questions :

a) $\int_0^{2\pi} \sin^6 t \, dt =$ [2]

i) $\frac{5\pi}{8}$

ii) $\frac{5\pi}{32}$

iii) $\frac{5}{4}$

iv) 0

b) The equation of asymptote parallel to x-axis to the curve represented by the equation $y(1+x^2)=x$ is [2]

i) $x = 0$

ii) $y = 0$

iii) $y = x$

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

c) Centre (c) & radius (r) of the sphere $x^2 + y^2 + z^2 - 4x + 6y - 2z - 11 = 0$ is [2]

i) $c \equiv (2, 3, 1) \text{ \& } r = 5$

ii) $c \equiv (2, 3, 1) \text{ \& } r = \sqrt{14}$

iii) $c \equiv (2, -3, 1) \text{ \& } r = 5$

iv) $c \equiv (2, -3, 1) \text{ \& } r = \sqrt{14}$

P.T.O.

d) The value of the double integration $\int_0^1 \int_0^1 xy^2 \, dx dy$. [2]

i) $\frac{1}{4}$

ii) $\frac{1}{9}$

iii) $\frac{1}{2}$

iv) $\frac{1}{6}$

e) $\sqrt{n+1} =$ [1]

i) $(n+1)!$

ii) $(n-1)!$

iii) $(n+2)!$

iv) $n!$

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

i) Pole

ii) $\theta = 0$

iii) $\theta = \frac{\pi}{2}$

iv) $\theta = \frac{\pi}{4}$

Q2) a) If $I_n = \int_0^{\pi/2} x \sin^n x \, dx$ then prove that $I_n = \frac{n-1}{n} I_{n-2} + \frac{1}{n^2}$. [5]

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

c) Evaluate $\frac{d}{dx} \operatorname{erf}(ax^n)$. [5]

OR

Q3) a) If $I_n = \int_0^{\pi/2} \cos^n x \cos nx \, dx$, then prove that $I_n = \frac{1}{2} I_{n-1}$. [5]

b) Evaluate $\int_0^2 x(8-x^3)^{1/3} \, dx$. [5]

c) Show that $\int_0^\infty \frac{e^{-bx} \sin ax}{x} \, dx = \tan^{-1} \frac{a}{b}$. [5]

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

OR

Q5) a) Trace the curve $y(x^2 + 4a^2) = 8a^3$. [5]

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

c) Find the arc length of cardioide $r = a(1 + \cos \theta)$ which lies outside the circle $r + a \cos \theta = 0$. [5]

Q6) a) Prove that the sphere $x^2 + y^2 + z^2 + 2x - 4y - 2z - 3 = 0$ touch the plane $2x - 2y - z + 16 = 0$ and Find the point of contact. [5]

b) Find the equation of right circular cone with vertex at origin and axis as the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ & semivertical angle is 30° . [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]

OR

Q7) a) Show that the sphere $x^2 + y^2 + z^2 - 10x - 10y - 2z + 2 = 0$ and $x^2 + y^2 + z^2 + 6x + 2y - 2z + 2 = 0$ touches externally. Also find the point of contact. [5]

b) Find the equation of right circular cone whose vertex at $(0, 0, 10)$ & whose intersection with XOY plane is a circle of radius '5'. [5]

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

Q8) a) Evaluate $\iint e^{-(x^2+y^2)} dx dy$ over the positive quadrant of the circle $x^2 + y^2 = a^2$. [5]

b) Find the area between the curve $y = (x-4)(x+2)$ and the x -axis. [5]

c) Find the centre of gravity of the area enclosed by the parabolas $y^2 = x$ and $x^2 = y$. [5]

OR

Q9) a) Evaluate the following integration by changing the order : [5]

$$\int_0^\infty \int_y^\infty \frac{e^{-x}}{x} dx dy$$

b) Evaluate $\iiint \frac{dx dy dz}{1+x^2+y^2+z^2}$ 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 of one loop of the rose curve $r = a \cos 2\theta$ about initial line. (Given that density $\rho = \frac{8M}{a^2\pi}$, where M is Mass of the area). [5]



Total No. of Questions : 8]

SEAT No. :

PD-4033

[Total No. of Pages : 3

[6401]-1910

F.E.

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

Time : 2½ Hours]

[Max. Marks : 50

Instructions to the candidates:

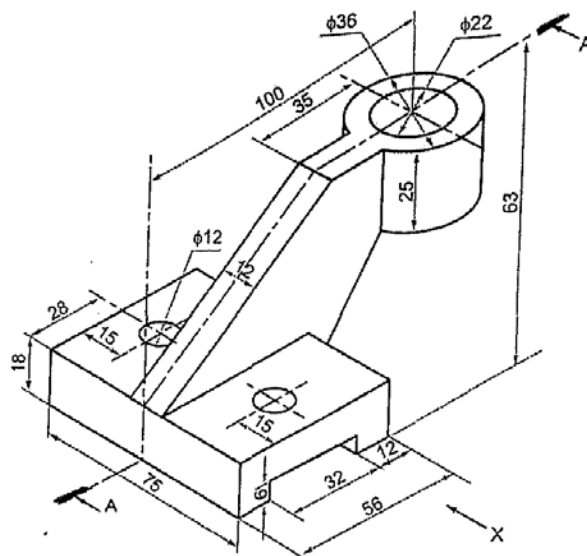
- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Assume suitable data, if necessary.
- 3) Retain all the construction lines.

Q1) Draw an ellipse by rectangular method if the major axis and minor axis are 100mm and 70mm respectively. **[8]**

OR

Q2) Draw Involute of a circle having 50 mm diameter and String length is equal to the circumference of circle. **[8]**

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

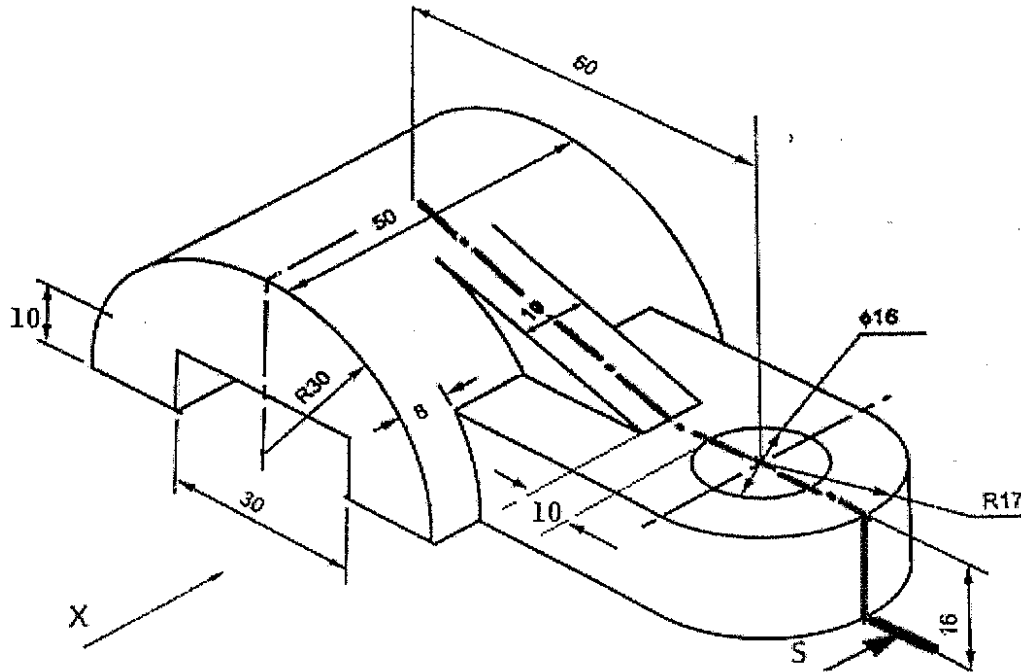


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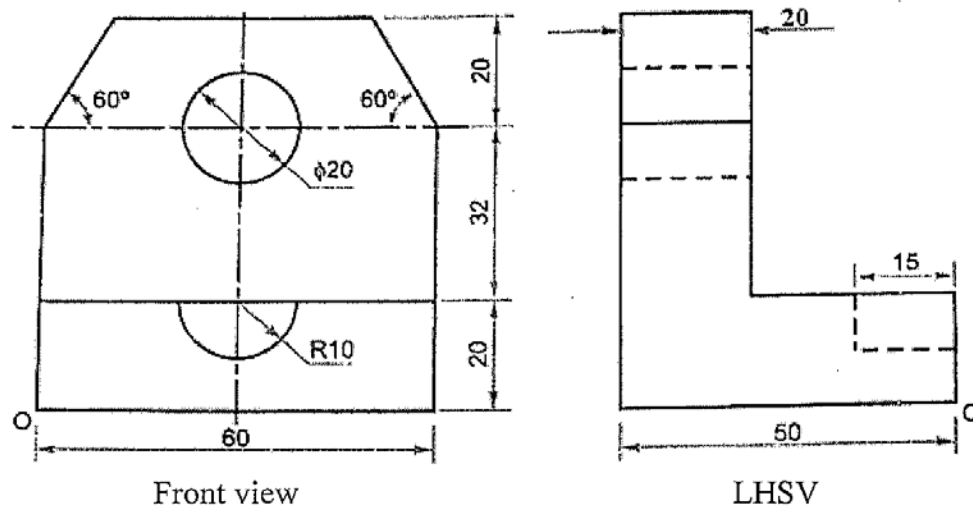
OR

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

- a) Sectional Front View in the X direction shown by S
- b) Top View
- c) Right-Hand Side View

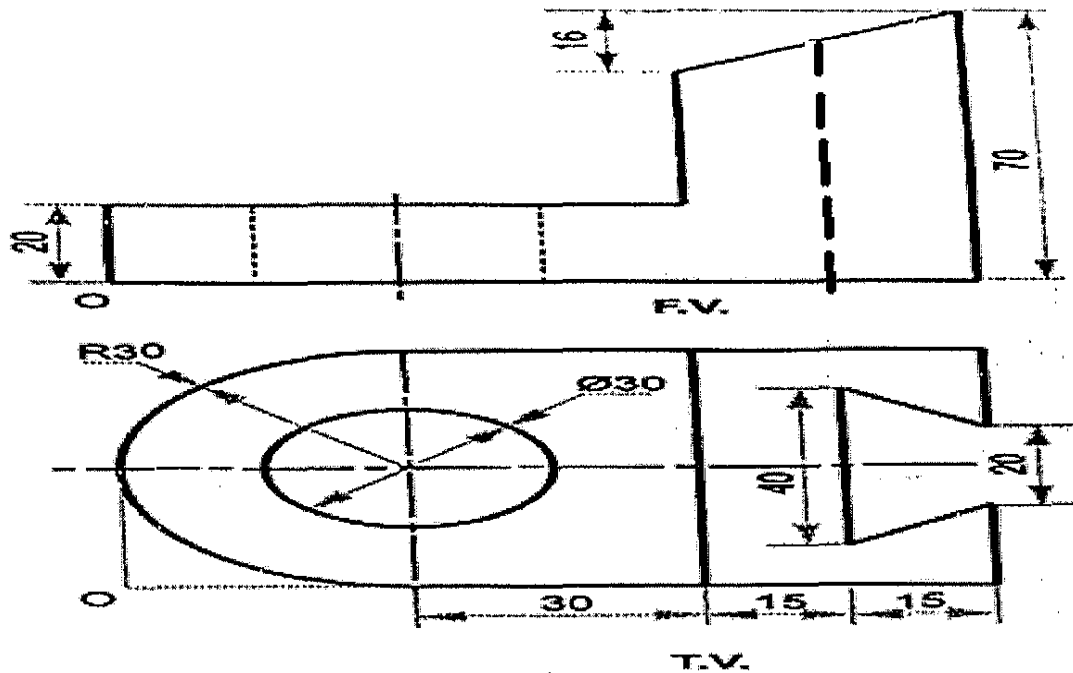


Q5) Figure show orthographic views of an object by first angle method of projection. Draw its isometric view and give all the dimensions. **[16]**



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) Draw the development of surface of the cone having base diameter 50 mm and axis height 70 mm. If it is cut by cutting plane which bisects the axis of the cone and inclined at 45° with HP. [10]

OR

- Q8) Draw the development of lateral surface of pentagonal prism of base side 35 mm & axis height 80 mm, has its one side of base is parallel to VP and corner is nearer to observer. It is cut by a cutting plane which is inclined at 30° to the HP and bisecting the axis of cylinder. [10]

