Total No. of Questions : 11]

SEAT No. :

PC-5147

[Total No. of Pages : 5

[6351]-111
F.E.
BSC - 101-BES : ENGINEERING MATHEMATICS - I
(2024 Pattern) (Semester - I)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) ***Q. 1 is Compulsory.***
2) ***Attempt Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9, Q.10 or Q.11.***
3) ***Neat diagrams 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 questions. **[10]**

i) $\lim_{x\to 0}\frac{1-\cos x}{x}$ is equal to _____ **[2]**

a) 0 b) 1

c) –1 d) 2

ii) if $u = x^y$ then $\frac{\partial u}{\partial x}$ is equal to _____ **[2]**

a) 0 b) yx^{y-1}

c) $x^y log x$ d) None of these

iii) If x = r cosθ, y = r sinθ then the value of $\frac{\partial(x,y)}{\partial(r,\theta)}$ is _____ **[2]**

a) r b) cosθ

c) 1 d) $\frac{1}{r}$

P.T.O.

iv) Rank of matrix $A=\begin{bmatrix}4 & 0 & 0\\ 0 & 3 & 0\\ 0 & 0 & 5\end{bmatrix}$ is _____ **[2]**

a) 4 b) 3
c) 2 d) 1

v) if $A^{-1} = A^T$ then, matrix A is _____ **[1]**

a) Orthogonal b) Singular
c) Regular d) None of above

vi) The eigen values of matrix $A=\begin{bmatrix}1 & 0 & 0\\ 0 & 3 & 0\\ 0 & -2 & 2\end{bmatrix}$ are _____ **[1]**

a) –2, 3, –1 b) –1, –2, –3
c) 1, 2, 3 d) 2, –2, 1

Q2) a) Prove that , is $0 < a < b$ $\frac{b-a}{1+b^2} < \tan^{-1}(b) - \tan^{-1}(a) < \frac{b-a}{1+a^2}$. **[4]**

b) Expand $2x^3 + 7x^2 + x - 6$ in powers of $(x - 2)$. **[4]**

c) Find the Fourier series for the function. $f(x) = x^2, -\pi < x < \pi$ and $f(x+2\pi) = f(x)$. **[4]**

OR

Q3) a) Verify Rolle's theorem for the function $f(x) = x^2$, $x \in (-1,1)$. **[4]**

b) Expand $\sqrt{1+\sin x}$ upto x^6. **[4]**

c) Obtain the half range sine series for the function $f(x) = 2-x$, $0 < x < 2$. **[4]**

Q4) a) if $u = \log(x^2 + y^2)$, verify $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$ **[4]**

b) If $u = \sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$ then prove that

$$x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = \frac{1}{4}(\tan^3 u - \tan u).$$ **[4]**

c) If $z = f(u,v)$ and $u = \log(x^2 + y^2)$, $v = y/x$ then show that $x\frac{\partial z}{\partial y} - y\frac{\partial z}{\partial x} = (1+v^2)\frac{\partial z}{\partial v}$. **[4]**

OR

Q5) a) If $u = 2x + 3y, v = 3x - 2y$ then find the value of $\left(\frac{\partial u}{\partial x}\right)_y \left(\frac{\partial y}{\partial v}\right)_x \left(\frac{\partial x}{\partial u}\right)_y \left(\frac{\partial v}{\partial y}\right)_u$ **[4]**

b) If $u = \tan^{-1}\left(\frac{x^3 + y^3}{x - y}\right)$, prove that

$$x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = (1 - 4\sin^2)\sin^2 u .$$ **[4]**

c) If u = f (x – y, y –z, z – x) then prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$ **[4]**

Q6) a) Examine the functional dependence for $u = \sin^{-1}x + \sin^{-1}y$; **[4]**

$v = x\sqrt{1 - y^2} + y\sqrt{1 - x^2}$, if dependent, find relation between them.

b) Examine maxima and minima for $f(x,y) = 4x - x^2 - y^2$, also find the extreme value of the function. **[4]**

c) If $u^3 + v^3 + x + y = 0$ and $x^3 + y^3 + u + v = 0$ then find $\frac{\partial u}{\partial y}$. **[4]**

OR

Q7) a) If $x + y + u^2 - v^2 = 0$ and $u + v + x^2 - y^2 = 0$ find $\frac{\partial(u,v)}{\partial(x,y)}$ **[4]**

b) While calculating the volume of right circular cone, the errors of 2% and 1% are made in measuring the height and radius of the base of right circular cone respectively find the percentage error in calculated volume. **[4]**

c) Find the minimum distance from origin to the plane $3x + 2y + z = 12$, using Lagrange's method of undetermined multiplier method. **[4]**

Q8) a) Examine consistency for the system of equations, $x+y-3z=1; 4x-2y+6z=8; 15x-3y+8z=20$. **[4]**

b) Examine for linear dependence and find relation if following vectors are dependent (1, 1, 3), (1, 2, 4) & (1, 0, 2). **[4]**

c) Show that $A=\frac{1}{3}\begin{bmatrix}1 & 2 & 2\\ 2 & 1 & -2\\ 2 & -2 & 1\end{bmatrix}$ is orthogonal matrix and hence write A^{-1}.

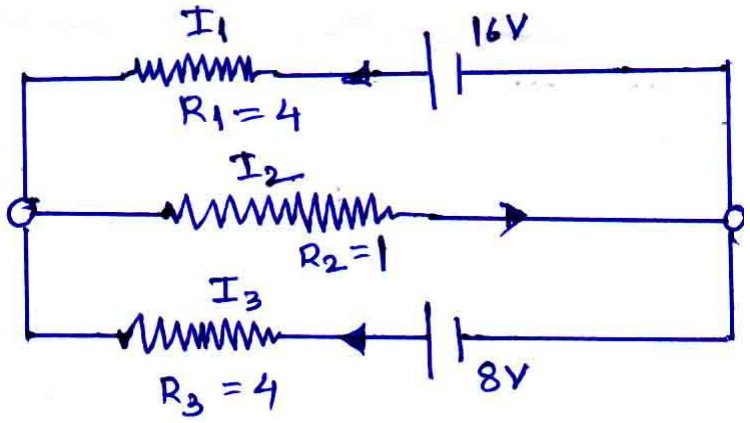
[4]

OR

Q9) a) Examine consistency for the following set of equations and obtain solution if consistant $2x-y-z=2; x+2y+z=2; 4x-7y-5z=2$. **[4]**

b) Examine the vectors for linear dependence and if dependent find relation between them, (1, 1, 1), (1, 2, 3), (2, 3, 8) and (3, 4, 9). **[4]**

c) Find the currents I_1, I_2, I_3 in the following circuit as shown in the figure. **[4]**



Q10)a) Verify Cayley Hamilton theorem for $A=\begin{bmatrix}1 & 0 & 1\\ 0 & 1 & 0\\ 0 & 0 & 1\end{bmatrix}$ Hence find A^{-1}, if it exists. **[6]**

b) Find modal matrix p to reduce $B=\begin{bmatrix}1 & 0 & 0\\ 0 & 3 & -1\\ 0 & -1 & 3\end{bmatrix}$ to diagonal form write the corresponding linear transformation. **[6]**

OR

Q11)a) Find eigen values and corresponding eigen vectors for

$$A = \begin{bmatrix} 1 & -1 & 0 \\ -1 & 2 & 1 \\ 0 & 1 & 1 \end{bmatrix}$$ **[6]**

b) Express $Q(x) = 2x_1^2 + 2x_2^2 + 2x_3^2 - 2x_1x_3$ to canonical form by orthogonal transformation write the orthogonal transformation. **[6]**

Total No. of Questions : 11]

SEAT No. :

PC5148

[Total No. of Pages :4

[6351]-112

F.E.

BSC-102-BES : ENGINEERING PHYSICS

(2024 Pattern) (Semester-I) (Credit System)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Question No. 1 is compulsory.***
2) ***Questions No. 2 to No. 11 carry equal marks.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***
5) ***Use of an electronic calculator is allowed.***

Physical Constants:

- Mass of electron, $m_e = 9.1 \times 10^{-31}$ kg
- Charge on electron, $e = 1.6 \times 10^{-19}$ C
- Planck's constant, $h = 6.63 \times 10^{-34}$ J-sec

Q1) Multiple choice questions. **[10×1=10]**

a) The process of raising the atoms from a lower energy state to a higher one to create population inversion is called:

i) Pumping ii) Stimulated emission

iii) Spontaneous emission iv) Absorption

b) The main principle of optical fiber is:

i) Total internal reflection ii) Total internal refraction

iii) Total internal dispersion iv) None of the above

c) The full form of STM is:

i) Scientific technical microscope

ii) Scanning tunneling microscope

iii) Super tensile microscope

iv) None of the above

P.T.O.

d) The wavelength of a matter wave is ____ to the velocity of the particle:

i) Equal
ii) Inversely proportional
iii) Directly proportional
iv) Independent

e) The condition for a dark fringe in a reflected system for a uniform thickness thin film is:

i) $2\mu t \cos r = n\lambda$
ii) $2\mu t \sin r = n\lambda$
iii) $2\mu t \cos r = (2n \pm 1))\lambda/2$
iv) $2\mu t \sin r = (2n \pm 1)\lambda/2$

f) In a positive crystal, the velocity of the O-ray is:

i) half of velocity of the E-ray
ii) Less than the velocity of the E-ray
iii) Greater than the velocity of the E-ray
iv) None of the above

g) Pure semiconductors are known as:

i) Compound
ii) Extrinsic
iii) Doped
iv) Intrinsic

h) Hall Effect is true for:

i) Metals only
ii) Semiconductors only
iii) N-type semiconductors only
iv) Both metals and semiconductors

i) Superconductors are perfectly:

i) Paramagnetic
ii) Ferromagnetic
iii) Diamagnetic
iv) All of the above

j) Nanostructures have sizes between:

i) 1-100 Å
ii) 1 - 100 nm
iii) 100 - l000nm
iv) None of the above

Q2) a) With a neat labelled diagram, explain the construction, and working of a CO2 laser. **[6]**

b) If an optical fiber has a core refractive index of 1.55 and a cladding refractive index of 1.46, calculate the Numerical Aperture of the fiber. **[3]**

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

i) Metastable state

ii) Population inversion

iii) Stimulated emission

OR

Q3) a) What is attenuation in optical fibers? Discuss in brief the various internal and external factors responsible for attenuation. **[6]**

b) What is a LASER? State important characteristics of a laser. **[3]**

c) Differentiate between step index and graded index fibers. (Any three points) **[3]**

Q4) a) Derive the Schrödinger's Time-Independent Wave Equation. **[6]**

b) For an electron accelerated by a potential difference V, derive the expression for its de Broglie wavelength. **[3]**

c) Find the lowest energy of an electron confined to a box of length 1 Å. **[3]**

OR

Q5) a) With a neat labelled diagram, explain the principle, construction, and working of a Scanning Tunnelling Microscope (STM). **[6]**

b) State the properties of matter waves (Any three). **[3]**

c) If the de Broglie wavelength is 0.72 AU, then find the momentum of the particle. **[3]**

Q6) a) State the phenomenon of double refraction. Hence, explain Huygens's wave theory of double refraction. **[6]**

b) Explain the application of interference in: **[3]**

Antireflection coating

c) How should the Polarizer and Analyzer be oriented to reduce the intensity of the beam to ½ of its original intensity. **[3]**

OR

Q7) a) Derive the conditions for brightness and darkness for the thin parallel film of thickness t and refractive index μ. **[6]**

b) State and explain Malus's Law. **[3]**

c) A beam of monochromatic light of wavelength 5.82×10^{-7}m falls normally on a glass wedge of angle 20 sec. If the refractive index (RI) of glass is 1.5, find the bandwidth. **[3]**

Q8) a) Explain the classification of solids into conductors, semiconductors, and insulators on the basis of band theory. **[6]**

b) State the any three properties of ultrasonic waves. **[3]**

c) An ultrasonic pulse is sent through a block of copper. The echo pulse is recorded after 4 μs. If the velocity of ultrasonic waves in copper is 5000 m/s, calculate the thickness of the copper block. **[3]**

OR

Q9) a) With a neat labelled diagram, explain the principle, construction, and working of a Piezoelectric Oscillator. **[6]**

b) Write the formula for the Fermi-Dirac probability distribution function, specifying the meaning of each symbol. **[3]**

c) For a P-N junction diode, draw an energy band diagram showing the position of the Fermi level in: **[3]**

Forward bias mode

Q10)a) Explain the Optical and Mechanical properties of nanoparticles. **[6]**

b) State and Explain the Meissner effect. Show that superconductors exhibit perfect diamagnetism. **[6]**

OR

Q11)a) What are the types of superconductors? Distinguish between them. **[6]**

b) What is quantum confinement? How does it affect the properties of nanoparticles? Explain the ball milling method for the synthesis of nanoparticles. **[6]**

Total No. of Questions : 11]

SEAT No. :

PC5149

[Total No. of Pages : 4

[6351]-113
F.E.
BSC - 103 - BES : ENGINEERING CHEMISTRY
(2024 Pattern) (Credit System) (Semester - I)

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, Q.10 or Q.11.***

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

a) The colour of Metal -EDTA complex is _____

i) blue ii) wine red

iii) pink iv) colourless

b) The process of removing salts from brackish water is _____

i) desalination ii) degasification

iii) distillation iv) degradation

c) Which of the following electronic transition requires the highest energy

i) $\sigma \rightarrow \sigma^*$ ii) $\eta \rightarrow \pi^*$

iii) $\pi \rightarrow \pi^*$ iv) $\eta \rightarrow \sigma^*$

d) In conductometric titration between strong acid and strong base reaction, the conductance of the solution _____

i) decreases upto endpoint & then increases

ii) increases upto endpoint & then decreases

iii) increases upto endpoint & then remains constant

iv) decreases upto end point & then remains constant

e) Polymers that do not become soft on heating & hard on cooling are _____

i) thermoplastic polymers ii) thermosetting polymers

iii) thermoelastic polymers iv) thermotropic polymers

P.T.O.

f) Graphene is _____ nanomaterial.

i) zero dimensional ii) one dimensional

iii) two dimensional iv) three dimensional

g) Kjeldahl's method is used for determination of _____

i) % N ii) % C

iii) % 0 iv) % Ash

h) NCV = GCV – _____ × H × 587 cal/gm.

i) 0.9 ii) 0.09

iii) 9.0 iv) 90.0

i) PBR gives an idea regrarding _____

i) Nature of oxide film formed ii) Rate of neutralisation

iii) quality of fuel iv) pH

j) The process of coating tin on steel to prevent it from rusting is called as _____

i) tinning ii) galvanisation

iii) annealing iv) silver plating

Q2) a) What are scales & sludges? Explain the causes of scale formation in boiler. **[6]**

b) Explain reverse osmosis process with figure. **[3]**

c) The hardness of 50,000 litres of a water sample was removed by passing it through a zeolite softener. The softener required 250 litres of NaCl containing 100 gm/lit of NaCl for regeneration. Calculate hardness of water. **[3]**

OR

Q3) a) What is hardness of water? Explain the procedure of EDTA method for determination of total hardness. Give formula for total hardness and reactions involved. **[6]**

b) Give cation & anion exchange reaction for deionisation of water containing $MgCl_2$. **[3]**

c) 100 ml of water sample on titration with N/50 HCl required 7.6 ml for phenolphthalein end point & 15.2ml for total alkalinity reading. Identify type & amount of alkalinity present in water sample. **[3]**

Q4) a) State Beer's law and Lambert's law. Draw diagram of double beam spectrophotometer & state the function of any 2 components of spectrophotometer. **[6]**

b) Draw a labelled diagram of calomel electrode. Write its cell representation & give anyn 2 disadvantages. **[3]**

c) Define:- **[3]**

i) Specific conductance

ii) Motar conductance

iii) Cell constant

OR

Q5) a) Explain various stages of pH metric titration for strong acid and strong base with titration curve and reaction involved init. Give any 2 applications of pH metry. **[6]**

b) Explain any 3 applications of conductometry. **[3]**

c) Define:- **[3]**

i) Auxochrome

ii) Hypso chromic shift

iii) Hyper chromic shift

Q6) a) What are bio degradable polymers? Explain factors responsible for bio degradation. Draw structure of (biopol) PHBV & give its 2 applications. **[6]**

b) Give structure, 2 properties & 2 applications of polycarbonate. **[3]**

c) What are quantum dots? Give any 2 types of quantum dots. Write any 2 applications of it. **[3]**

OR

Q7) a) Explain structure of graphene with diagram. Give its 3 properties and 3 applications. **[6]**

b) What are nanomaterials? Classify it on the basis of zero and one dimensional with respect to example of each. **[3]**

c) Define conducting polymers. Explain p-doping with reaction. **[3]**

Q8) a) What is proximate Analysis? Explain the procedure with formula used for determination of various constituents. **[6]**

b) What are Li ion batteries? Explain its construction. **[3]**

c) The following observations were noted in Boy's gas calorimeter experiment- **[3]**

Volume of gas burnt at STP = 0.1 m^3,

Mass of cooling water used = 27kg,

Temperature of inlet & outlet water are 24ºC & 29ºC respectively.

Mass of steam condensed = 0.04kg

Find GCV and NCV of the fuel

OR

Q9) a) Explain production of hydrogen gas by steam reforming of methane & coke with reaction conditions & method for removal of CO_2 gas. **[6]**

b) Give preparation with reaction of power alcohol. **[3]**

c) 2.4 gm of coal in quantitative analysis gave 0.20 gm of $BaSO_4$. Calculate % Sm the coal. **[3]**

Q10)a) What is wet corrosion? Give the conditions under which wet corrosion occurs. Explain hydrogen evolution mechanism of wet corrosion. **[6]**

b) i) Explain any 3 factors affecting rate of corrosion with respect to nature of metal. **[3]**

ii) What are anodic & cathodic coatings? Which is better? **[3]**

OR

Q11)a) Explain cathodic protection method using sacrificial anode with figure. Give any 2 advantages & any 2 applications of it. **[6]**

b) i) Explain the process of galvanising on steel with the help of suitable diagram. **[3]**

ii) Give the reaction & type of oxide film formed in the oxidation corrosion of Cr & Mo metal. **[3]**

❋ ❋ ❋

Total No. of Questions : 10]

SEAT No. : ____

PC-5205

[Total No. of Pages : 3

[6351]-114

First Year of Engineering

BASIC ELECTRONICS ENGINEERING

(2024 Pattern) (Semester - I) (ESC-101-ETC)

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

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.***
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 electronic pocket calculator is allowed.***

Q1) a) Explain the Impact of Electronics on industry and society? **[5]**

b) Draw circuit diagram and explain operation of Bridge Rectifier with the help of neat waveforms? **[5]**

c) Compare Active and Passive Components. **[4]**

OR

Q2) a) Draw circuit diagram and explain operation of Half-Wave Rectifier with the help of neat waveforms? **[5]**

b) Draw and explain V-I characteristics of P-N Junction Diode. **[5]**

c) Compare LED and Photodiode. **[4]**

Q3) a) What is N-Well method of VLSI CMOS manufacturing. **[5]**

b) Draw the construction diagram and explain the operation of Enhancement type N-channel MOSFET in detail? **[5]**

c) Determine the dc current gain β (Beta) and the emitter current IE for a transistor where I_B = 100 μA and I_C = 5.65 mA. **[4]**

OR

P.T.O.

Q4) a) Draw and explain MOSFET as Switch. **[5]**

b) Draw and explain the Output Characteristics of BJT in common emitter configuration and explain in detail? **[5]**

c) Determine the dc current gain β (Beta) and the emitter current IE for a transistor where I_B = 50 μA and I_C = 3.65 mA. **[4]**

Q5) a) Classify the different types of Logic Gates? Draw and explain any two Logic gates with its truth table & logic equation. **[5]**

b) Draw the block diagram of Microprocessor and explain the functions of each block in detail. **[5]**

c) Convert : **[4]**

i) $(1100111)_2$ into $(--)_{10}$

ii) $(75.371)_{10}$ into $(--)_2$

OR

Q6) a) State and Prove De-Morgan's Theorem. **[5]**

b) Draw & Explain Full Adder Circuit with truth table. And logical expression. **[5]**

c) Compare Microprocessor and Microcontroller in detail. **[4]**

Q7) a) Draw the block diagram of Digital Multimeter, Explain the function of each block. **[5]**

b) Draw the Functional block diagram of operational amplifier and explain in detail. **[5]**

c) Write any two Ideal and Practical characteristic of Op-Amp IC 741 **[4]**

OR

Q8) a) Draw the block diagram of Function Generator. Explain the function of each block. **[5]**

b) For inverting amplifier using op-amp. If R1 = 1kΩ and Rf = 10kΩ with V_{CC} = ±12V applied calculate output voltage if, i) Vin = 20mV ii) Vin = 2.2V Justify answer **[5]**

c) Draw and explain the block diagram of Regulated DC power supply. **[4]**

Q9) a) What is the Selection criteria used while selecting the sensors for particular application? **[5]**

b) Draw and explain Electromagnetic Frequency Spectrum with their applications. **[5]**

c) Comparison of Active Sensors and Passive Sensors. **[4]**

OR

Q10)a) Describe the Block diagram of IoT based Data Acquisition. **[5]**

b) Describe the Block diagram of GSM. **[5]**

c) Describe the Basic block diagram of Communication System. **[4]**

Total No. of Questions : 5]

SEAT No. : ____

PC5150

[Total No. of Pages : 3

[6351]-115

F.E.

ESC-102-ELE: BASIC ELECTRICAL ENGINEERING

(2024 Pattern) (Credit System) (Semester - I)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Attempt any one from each sub question.***
3) ***Figures to the right indicate full marks.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Assume suitable additional data, if necessary.***
6) ***Use of non-programmable calculator is allowed.***

Q1) a) Attempt any One. **[6]**

i) Draw and explain single line diagram for elementary power system and list down any four components associated with electrical power system.

ii) Derive the expressions for conversion of a delta connected resistive network into an equivalent star connected resistive network.

b) Attempt any One. **[8]**

i) State meaning of unilateral and bilateral network and find current through 5 ohm resistance by loop analysis method in Figure 1 (All resistances are in ohm)

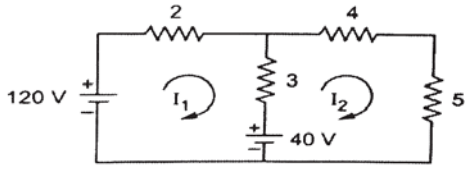


Figure 1

ii) State superposition theorem and find current through 5 ohm resistance by using this theorem in Figure 1.

Q2) a) Attempt any One. **[6]**

i) Draw series magnetic circuit with small airgap provided on an iron ring. Also draw an equivalent electrical circuit of this magnetic circuit. Show various electrical and magnetic circuit parameters in both diagrams. Write expression to calculate flux in this magnetic circuit.

ii) Define self-inductance and derive expression of energy stored in inductor coil in terms of self-inductance.

P.T.O.

b) Attempt any One. **[8]**

i) Define MMF and reluctance. An iron ring of mean length 100 cm and cross- sectional area of 120cm^2 with an air gap of 2 mm has a winding of 500 turns. The relative permeability of iron is 600. When a current of 3 A flows in the winding, determine reluctance of iron, reluctance of air gap & magnetic flux. (Neglect magnetic leakage & fringing).

ii) State relationship between self-inductance and mutual inductance between two magnetically coupled coils. Calculate mutual inductance and self-inductance of each coil if two coils of 250 and 750 turns respectively. They are wound on iron ring of mean diameter 175mm and cross section area of 750 sq mm with relative permeability of 1500. Assume perfect coupling between two coils.

Q3) a) Attempt any One. **[6]**

i) Derive the expression for RMS value in terms of its maximum value for sinusoidally varying alternating current.

ii) Obtain the expression for instantaneous power in case of purely capacitive circuit and by using this expression, prove that this circuit never consumes power.

b) Attempt any One. **[8]**

i) Define form factor and peak factor. Root means square value of a pure sine wave shaped alternating current is 10A. Waveform completes half cycle in 10ms when starting at t=0 sec. Write the equation of current and estimate instantaneous values at t=l5ms and t=4ms in first complete cycle.

ii) Draw phasor diagram for purely inductive and capacitive circuit. There are two impedances $Z_1 = 3 + j\,4$ and $Z_2 = 6 - j\,8$. Carry out following mathematical operations to find Z (equivalent) in rectangular form.

1) $Z_1 \times Z_2$

2) $Z_2 - 3\,Z_1$

3) $Z_2 - 2\,Z_1$

Q4) a) Attempt any One. **[6]**

i) Derive expression for resonance frequency in RLC series circuit and show how reactance's, impedance and current vary with frequency.

ii) Derive the relation between line voltage and phase voltage for three phase star connected balanced R-L load.

b) Attempt any One. **[8]**

i) Explain power triangle in R-L circuit and estimate three types of powers in a typical motor winding circuit having resistance of 30 ohm and inductive reactance of 40 ohm when connected across 230V AC supply.

ii) With the help of diagram show how to get a single-phase supply from a three-phase supply system. Three phase load consist of 100 ohm resistance in each branch and is connected to 3 Ph, 415V, 50Hz supply. Calculate phase voltage, line current, and active power, when load is connected in star and then in delta.

Q5) a) Attempt any One. **[6]**

i) With the help of suitable diagrams, explain working principle of three phase induction motor and state any four applications of same.

ii) Draw sectional view of DC motor and state functions of any three parts.

b) Attempt any One. **[8]**

i) Explain working principle of transformer. Calculate primary turns, full load secondary current and maximum flux in core of a single-phase transformer having rating of 10kVA 3300V/220V, 50Hz. EMF per turn is 10V.

ii) Write formula of copper loss and iron loss in single phase transformer. Full load copper loss and iron loss of a 80KVA, l000V/ 250V, 50Hz, transformer are 1200W and 800W respectively. Calculate efficiency at half load, unity power factor and full load, 0.8 power factor (lagging).

ⓘⓘⓘⓘ

Total No. of Questions : 10]

SEAT No. :

PC5151

[Total No. of Pages : 4

[6351]-116

F.E.

ESC-103-MEC : ENGINEERING GRAPHICS

(2024 Pattern) (Semester-I) (Credit System)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.***
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.***

Q1) A line AB of 90 mm long, having its endpoint A is on HP and 20 mm in front of VP. The plan length of the line AB is 70 mm and makes an angle of 40° with XY. Draw the projections of line AB. Find the inclination made by the line with HP and VP. **[12]**

OR

Q2) The point P of line PQ is in HP while its other end Q is 50 mm above HP and 20 mm in front of VP. The line is inclined to VP at an angle of 40°. Draw the projections of line if its front view measures 78 mm. Find true length of line and the inclination made by the line with HP. **[12]**

Q3) A rhombus ABCD with diagonal AC =100 mm and BD =60 mm is resting on corner A in the Horizontal plane. Its corner B is 25 mm above Horizontal plane. Draw the projections of the plane, when top view of diagonal AC is inclined at an angle of 30° with the vertical plane. **[12]**

OR

Q4) A hexagonal plate of 35 mm side is resting on one of its corner on the HP. Draw projections of the plate when the plate surface makes an angle of 35° to HP and the diagonal passing through resting corner makes 22° inclination to VP. **[12]**

P.T.O.

Q5) a) Draw an involute of a circle of diameter 50 mm. **[7]**

b) Draw the development of lateral surface of the square pyramid of base edge 40 mm and axis height 75 mm, if one of the base diagonal is parallel to VP. **[7]**

OR

Q6) a) Construct a parabola by rectangle method, if base is 80 mm and the axis height is 120 mm. **[7]**

b) Draw the development of lateral Surface of pentagonal prism of base edge 30 mm and axis height 70 mm, if one of the base edge is parallel to VP. **[7]**

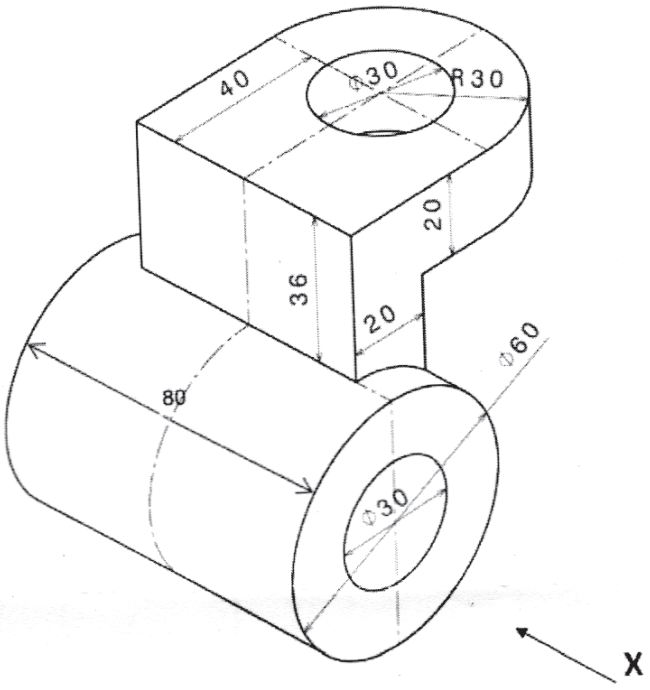
Q7) Fig. Shows a pictorial view of an object. Using first angle method of projection draw: **[16]**

a) Front View in the derection of X **[5]**

b) Top View **[5]**

c) Left Hand Side View **[5]**

d) Give Dimensions **[1]**



OR

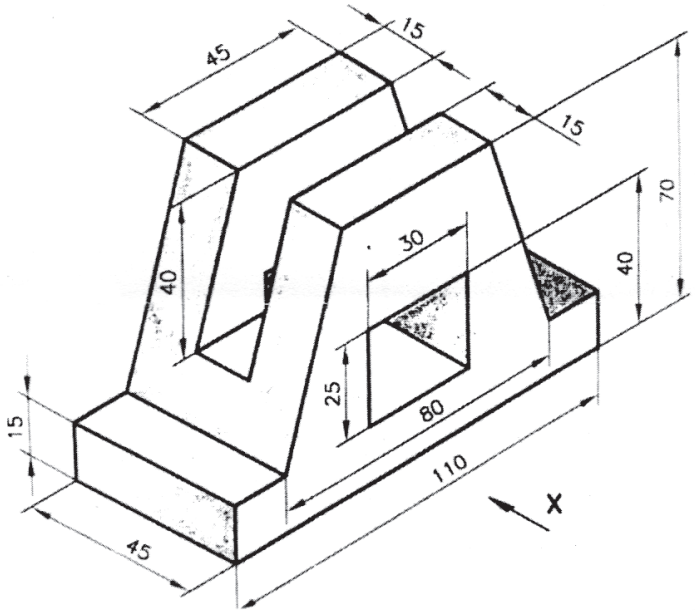
Q8) Fig. Shows a pictorial view of an object. Using first angle method of projection draw: **[16]**

a) Sectional Front View about its symmetry in the direction of X **[5]**

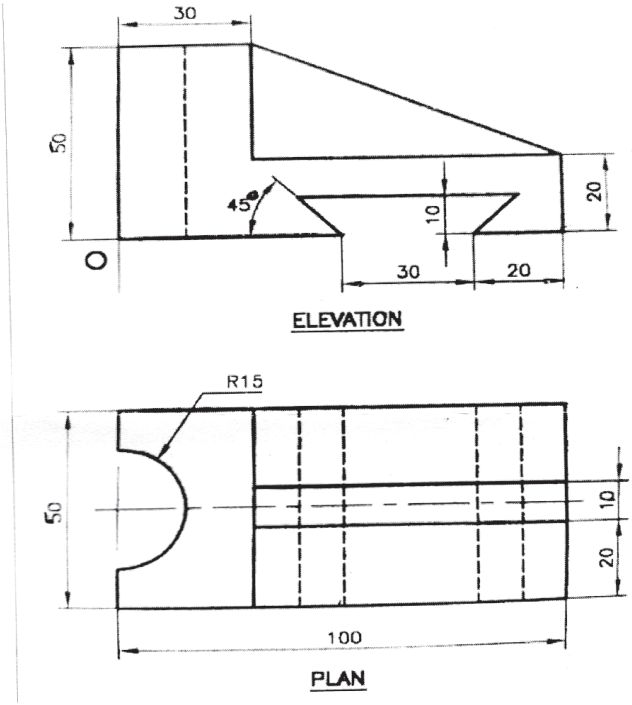
b) Top View **[5]**

c) Left Hand Side View **[5]**

d) Give Dimensions **[1]**

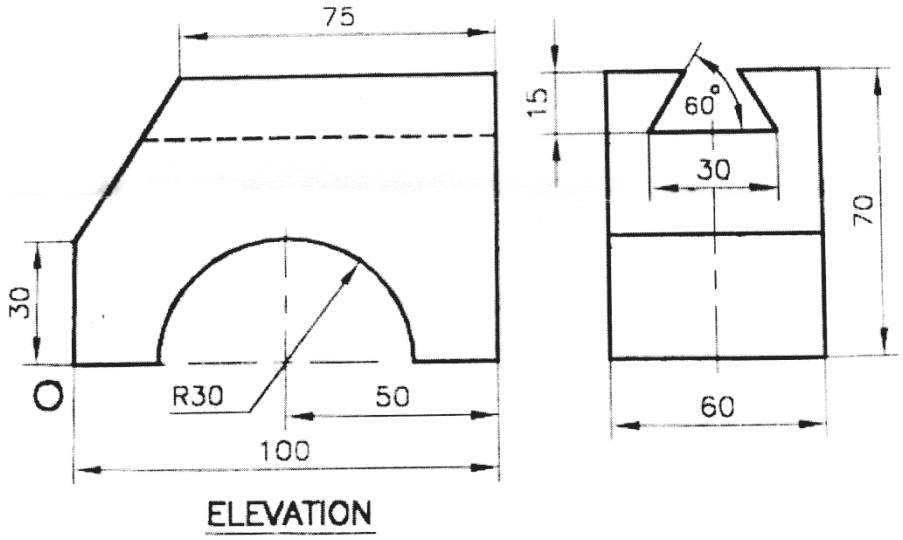


Q9) Isometric Projection-Figure shows front view and top view of an object. Draw isometric view and show overall dimensions. **[16]**



OR

Q10) Figure shows front view and side view of an object. Draw isometric view and show overall dimensions. **[16]**



Total No. of Questions : 6]

SEAT No. : ____

PC-5207

[Total No. of Pages : 5

[6351]-117
F.E.
ESC - 104 - CVL : ENGINEERING MECHANICS
(2024 Pattern) (Semester - I)

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

Instructions to the candidates :

1) ***All questions are compulsory.***
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) **Write the correct option for the following multiple choice questions.**

i) Two concurrent forces of 30 N and 40 N act an angle of 60°, find the resultant force. **[2]**

a) 54.59 N b) 36.06 N

c) 50 N d) None of these

ii) A clockwise moment of magnitude 10 Nm is acting at the center of simply supported beam of span 2 m. Find the reactions at right support. **[2]**

a) 10 N Upward b) 10 N Downward

c) 5 N Downward d) 5 N Upward

iii) A block of weight 200 N is placed on rough horizontal plane. If the coefficient of static friction between the block and the horizontal plane is 0.3, determine the horizontal force required to just slide the block on the plane. **[2]**

a) 60 N b) 200 N

c) 100 N d) 30 N

iv) A motorist travelling at a speed of 72 kmph sees a traffic signal 200 m ahead of him turn red. Determine the acceleration so that he will just stop at the signal. **[2]**

a) 1 m/s^2 b) – 1 m/s^2

c) 0.5 m/s^2 d) – 0.5 m/s^2

P.T.O.

v) A boy of mass 50 kg stands in a lift. Determine the force exerted by the boy on the floor of the lift when the lift moves down with a constant acceleration of 9.81 m/s^2. **[2]**

a) Zero
b) 490.5 N
c) 981 N
d) None of these

Q2) **Solve any two of the following :**

a) Find magnitude and direction of the resultant force with respect to origin 'o' for concurrent force system shown in **Fig. 2 a.** **[6]**

b) Determine magnitude, direction and point of application of the resultant with reference to point A for the force system as shown in **Fig. 2 b.** **[6]**

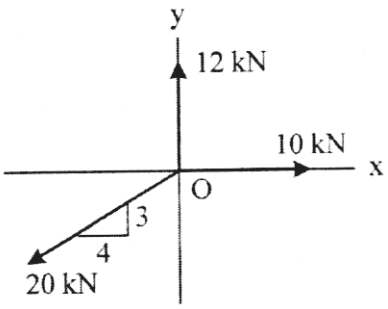


Fig. 2 a

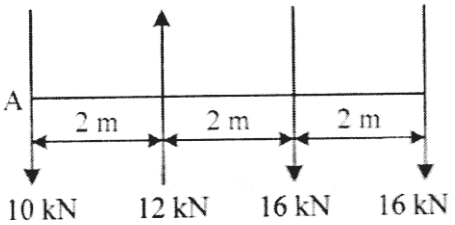


Fig. 2 b

c) Determine the magnitude and direction of resultant with reference to point A for the force system shown in **Fig. 2 c** if side of equilateral triangle is 1 m. **[6]**

d) Determine the y coordinate of centroid of the shaded area as shown in **Fig. 2 d.** **[6]**

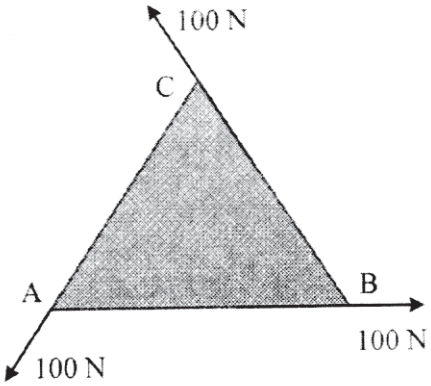


Fig. 2 c

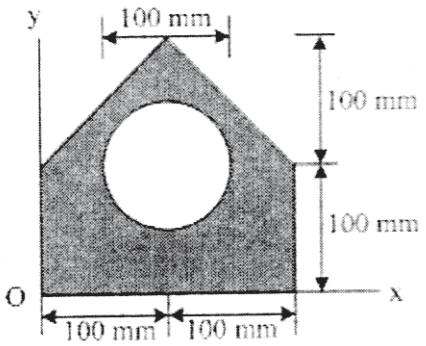


Fig. 2 d

Q3) **Solve any two of the following :**

a) Three cables are joined at the point C as shown in **Fig. 3 a.** Determine the tension in cable AC and BC caused by the mass of the 30 kg cylinder. **[6]**

b) The boom supports two vertical loads, F_1 and F_2 as shown in **Fig. 3 b.** 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 $F_1 = 2F_2$. **[6]**

c) Determine the force P shown in **Fig. 3 c** required to begin rolling the 100 mm radius uniform cylinder of mass 100 kg over the obstruction of height h =40 mm. **[6]**

d) Determine the support reaction for the simply supported beam loaded and supported as shown in **Fig. 3 d**. **[6]**

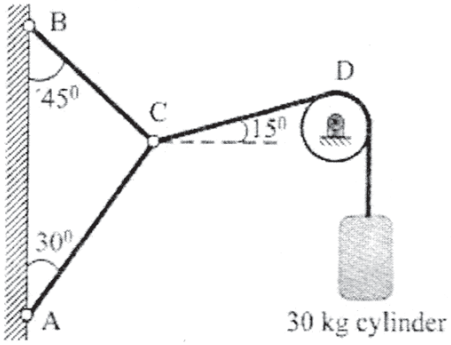


Fig. 3 a

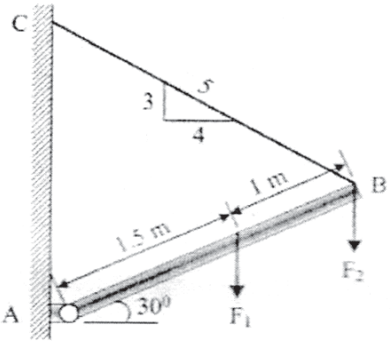


Fig. 3 b

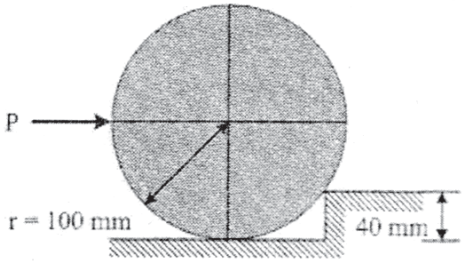


Fig. 3 c

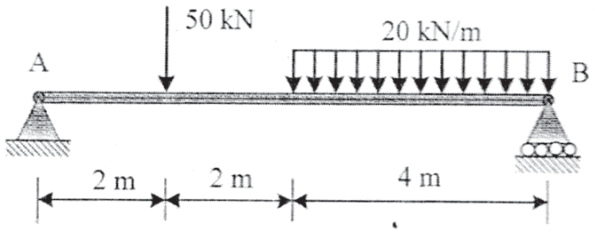


Fig. 3 d

Q4) **Solve any two of the following :**

a) Block of mass 10 kg rest on an inclined plane shown in **Fig. 4 a.** If the coefficient of static friction between block and plane is 0.25, determine the maximum force P to maintain equilibrium. **[6]**

b) A flexible cable which supports the 100 kg block is passed over a fixed circular drum shown in **Fig. 4 b** subjected to a force P to maintain equilibrium. If the coefficient of friction between the cable and drum is $\mu_S = 0.3$, determine the range of P. **[6]**

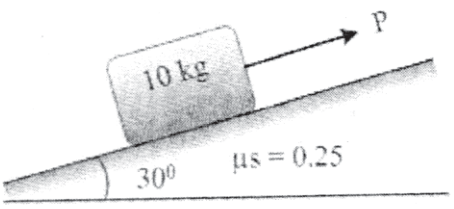


Fig. 4 a

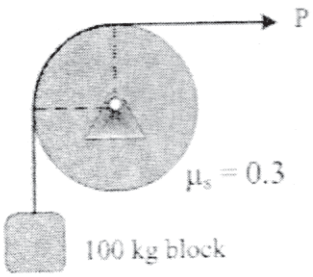


Fig. 4 b

c) The 15 m ladder has a uniform weight of 80 N. It rest against smooth vertical wall at B and horizontal floor at A. If the coefficient of static friction between ladder and floor at A is $\mu_S = 0.4$, determine the smallest angle θ with vertical wall at which the ladder will slip. **Refer Fig. 4 c**.**[6]**

d) Identify the zero force member and find forces in remaining members of the truss loaded and supported as shown in **Fig. 4 d**. **[6]**

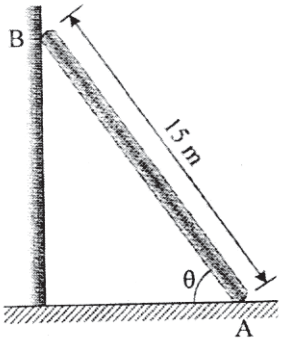


Fig. 4 c

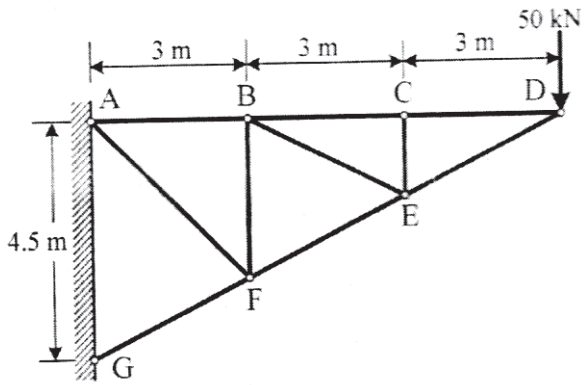


Fig. 4 d

Q5) **Solve any two of the following :**

a) A truck travels 164 m in 8 s and decelerated at a constant rate of 0.5 m/s^2. Determine (i) its initial velocity, (ii) its final velocity, (iii) the distance travel during the first 0.6 s. **[6]**

b) The acceleration of a particle is given by $a = 4t - 30$, where a is in m/s^2 and t is in seconds. If at $t = 0$, $v = 3$ m/s and s = – 5 m then determine the velocity and displacement at $t = 3$ s. **[6]**

c) A car is traveling along a circular curve that has a radius of 50 m. If its speed is 16 m/s and tangential component of acceleration a_t is 8 m/s^2, determine the magnitude of its total acceleration at this instant. **[6]**

d) The ball is kicked with an initial velocity $V_A = 8$ m/s at an angle $\theta_A = 40°$ with horizontal as shown in **Fig. 5 d**. Find the time of flight and maximum horizontal distance AB travel by ball. **[6]**

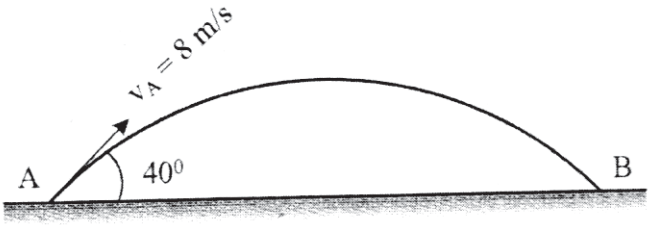


Fig. 5 d

Q6) **Solve any two of the following :**

a) An 80 kg block rests on a plane as shown in the **Fig. 6 a**. Find the acceleration with which block slides down using Newton's second law if coefficient of kinetic friction is, $\mu_k = 0.20$. **[6]**

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

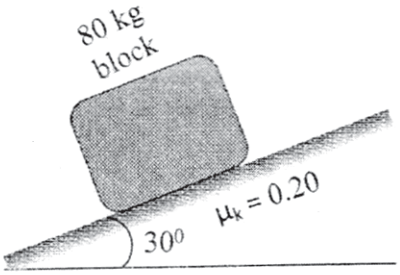


Fig. 6 a

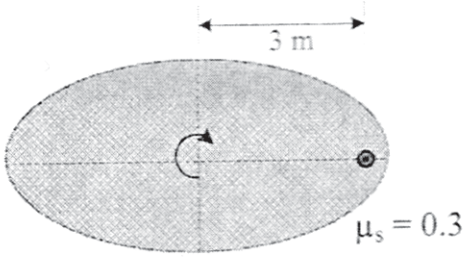


Fig. 6 b

c) The identical 1.2 kg collars A and B are sliding on a frictionless rod as shown in **Fig. 6 c**. Knowing that the coefficient of restitution, $e = 0.65$, determine the velocity of each collar after impact. **[6]**

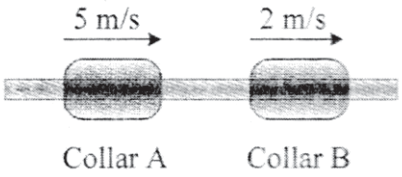


Fig. 6 c

d) A ball has a mass of 30 kg and is thrown.upward with a speed of 15 m/s. Determine the time to attain maximum height using impulse momentum principle. Also find the maximum height. **[6]**

▽▽▽▽

Total No. of Questions : 10]

SEAT No. :

PC-5208

[Total No. of Pages : 2

[6351]-118

F.E.

FUNDAMENTALS OF PROGRAMMING LANGUAGES

(ESC - 105 - Com) (2024 Pattern) (Semester - I)

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, Q.9 or Q10.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Assume suitable data, if necessary.***

Q1) a) Define an algorithm and write an algorithm for addition of two numbers. **[3]**

b) Explain brief history of 'C' programming. **[3]**

c) Define an identifier in C. Explain rules of naming an identifier. **[4]**

d) Explain data types in C. **[4]**

OR

Q2) a) Draw a flowchart for division of two numbers. **[3]**

b) Explain tokens in C programming. **[3]**

c) Explain different storage classes in C. **[4]**

d) Define a constant in C. What are the different types of constants in C? **[4]**

Q3) a) Define an operator and operand in C programming. Give a suitable example. **[3]**

b) What is a conditional operator in C? Explain with a suitable example. **[3]**

c) Explain relational operators in 'C'. **[4]**

d) What is the use of assignment operators? Explain different assignment operators. **[4]**

OR

Q4) a) Explain different arithmetic operators with suitable example. **[3]**

b) What are the different logical operators in 'C'? **[3]**

c) Explain bitwise operators in 'C'. **[4]**

d) What do you mean by operator precedence? Specify the precedence of arithmetic operators. **[4]**

P.T.O.

Q5) a) Explain different conditional/branching statements in C programming. **[4]**

b) Explain while loop with syntax, Flowchart and give a suitable example. **[5]**

c) Write a program in C to find factorial of a number. **[5]**

OR

Q6) a) Explain use of break and continue statement in C programming with a suitable example. **[4]**

b) Explain for loop with syntax, flowchart and give a suitable example. **[5]**

c) Write program to check whether a number is even or odd. **[5]**

Q7) a) Explain one dimensional array with a suitable example. **[4]**

b) What are the different ways of initialization of arrays in C programming? **[5]**

c) Write a program in 'C' for addition of two matrices. **[5]**

OR

Q8) a) What are the properties of arrays in C? **[4]**

b) What are the different ways of string initialization? **[5]**

c) Write a program to count number of characters in a string using a looping statement. **[5]**

Q9) a) Explain user defined function definition with syntax and give a suitable example. **[4]**

b) What is a recursion? Explain it with a suitable example. **[5]**

c) Write a program for leap year using function. **[5]**

OR

Q10) a) Explain structure declaration and initialization. **[4]**

b) Explain function declaration, function definition and function call. Give a suitable example. **[5]**

c) Write a program for prime number using function. **[5]**

▽▽▽▽