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FACULTY OF ENGINEERING AND TECHNOLOGY
B.Tech. (II-Semester) (CBCS) Examination
Physics

Time: 3 Hours]

[Max Marks: 70

SECTION- A (Marks: 10 x 1=10)

Answer **ALL** questions

- 1 a) How do you interpret transformation of a vector under rotation?
- b) Write Newton's equation of motion in polar coordinates.
- c) Define conservative and non-conservative forces.
- d) What are damped oscillations?
- e) Define angular momentum of a rigid body.
- f) Write kinematics of system rotating in a plane.
- g) Write short notes on coffee-ring effect.
- h) Define divergence of static magnetic field.
- i) State and explain Lenz's law.
- j) Write the expression for the energy stored in an electromagnetic field.

SECTION- B (Marks: 5 x 12=60)

Answer any **Five** questions

- 2 a) Write Newton's laws and their completeness in describing the particle motion.
(Or)
- b) Solve the Newton's equations of motion in cylindrical coordinates.
- 3 a) Define Central forces and explain conservation of angular momentum.
(Or)
- b) Explain Forced oscillations in detail and define resonance.
- 4 a) Explain the rotational kinematics of a rigid body and deduce the equation of motion for a rotating rigid body.
(Or)
- b) Derive an expression for angular momentum of rigid body about a point in a plane. Derive Euler's equations.
- 5 a) Deduce Poisson's equations for electrostatic potential and discuss the uniqueness of the solution with steady state diffusion.
(Or)
- b) Obtain the expression for vector potential for a given magnetic field using Stoke's theorem.
- 6 a) State Faraday's law of electromagnetic induction. Discuss the equivalence of Faraday's law and motional EMF.
(Or)
- b) Explain in detail about flow of energy and Poynting vector with examples.
- 7 a) Obtain the solution for Newton's equation of motion in spherical coordinates
(Or)
- b) Explain continuity equation for current densities and how curl of a magnetic field is modified in order to satisfy the continuity equation.
- 8 a) Deduce Laplace's equations for electrostatic potential and discuss the uniqueness of the solution with steady state diffusion
(Or)
- b) Derive Maxwell's equations in vacuum and non conducting medium.

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FACULTY OF ENGINEERING AND TECHNOLOGY
B.Tech (II- Semester) (CBCS) Examination
Chemistry

Time: 3 Hours]

[Max marks: 70

SECTION – A (Marks: 10 x 1 = 10)

Answer ALL questions

- 1 a) Write Nernst equation.
- b) What are redox titrations?
- c) What are the important effects of corrosion?
- d) Classify hardness of water.
- e) Expand EDTA.
- f) Write the mechanism of SN^1 reactions.
- g) Give the structure of Paracetamol.
- h) Write the structures of d-orbitals.
- i) Mention any two salient features of CFT.
- j) How the energy and frequency of Electromagnetic radiation are related.

SECTION – B (Marks: 5 x 12 = 60)

Answer any **Five** questions

- 2 a) Discuss the construction and working of glass electrode and explain the determination of pH of a solution using glass electrode.
(Or)
- b) Discuss electrochemical series.
- 3 a) Explain the following factors affecting the rate of corrosion:
i) Ratio of anodic to cathodic areas ii) nature of corrosion product
(Or)
- b) i) How will you determine hardness of water by EDTA method?
ii) What is boiler feed water? Explain the scale and sludge formation in boiler.
- 4 a) Explain the following reactions:
i) Reduction of carbonyl compounds using $LiAlH_4$
ii) Synthesis and applications of Aspirine
(Or)
- b) Explain Markownikoff's and anti Markownikoff's additions with suitable examples.
- 5 a) i) Write about the salient features of Molecular Orbital Theory
ii) Construct the Molecular orbital energy level diagram of O_2
(Or)
- b) Explain the crystal field splitting of metal ion d-orbitals in Octahedral and Square planar geometries.

Contd..2..

- 6 a) Discuss the selection rules and applications of Electronic spectroscopy.
(Or)
b) Write a note on i) selection rules ii) modes of vibration in Infrared spectroscopy of diatomic molecules.
- 7 a) i) Define equivalent and molar conductance and explain how they are related to each other
i) Write a note on Galvanic cell
(Or)
b) i) Explain the mechanism of disinfection of water by ozonization.
ii) Discuss the softening of water by zeolite process.
- 8 a) Explain the mechanism of oxidation of alcohols using KMnO_4
(Or)
b) Discuss the working principle of Lead-acid battery.
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FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech. (II-Semester) (CBCS) Examination
ENGINEERING MECHANICS

Time: 3 Hours]

[Max Marks: 70

Section A (Marks 10 X 1=10)

I. Answer all questions:

- Distinguish between resolution and composition of forces.
- State the Lami's theorem.
- State the law of super position.
- Write a short note on Isolated body.
- State the assumptions made in plane truss.
- Define angle of friction.
- State perpendicular axis theorem.
- Define work, power and energy,
- What is D'Alemberts force?
- Differentiate between Impulse and Momentum.

Section B (Marks 5 X 12=60)

Answer any five questions

- What is force system? Explain various types of force systems with an example.
 - Determine the reactions at A and B of the beam as shown in Figure 1.

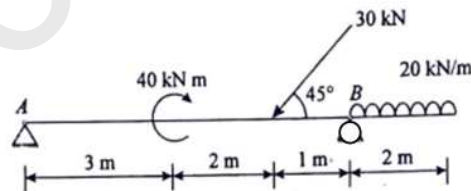


Figure 1

OR

- A roller of radius $r = 500$ mm and weight 4000 N is to be pulled over a curb of height 250 mm by a horizontal force P applied to the end of a string, wound tightly around the circumference of the roller shown in figure 2. Find the magnitude of force P required to start the roller move over the curb.

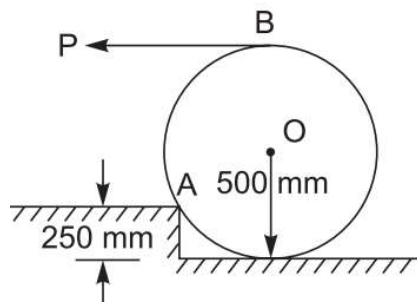


Figure 2

Contd..2..

-2-

- 3 a) A block of weight $W_1 = 200 \text{ N}$ rests on a horizontal surface and supports on top of it another block of weight $W_2 = 50 \text{ N}$ the block W_2 attached with vertical wall by a string AB , is shown in figure 3. Find the amount of horizontal force P , applied to the lower block necessary for impending slipping. The coefficient of static friction for all contiguous surfaces is $\mu=0.3$

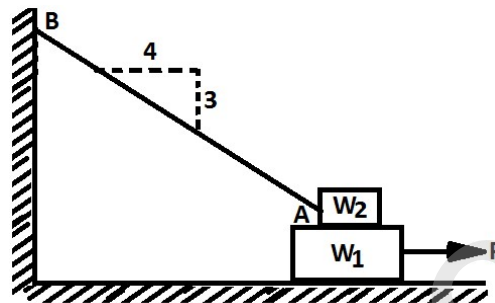


Figure 3

OR

- b) A plane truss is loaded and supported as shown in Figure 4. Determine the nature and magnitude of the forces in the members 1, 2 and 3

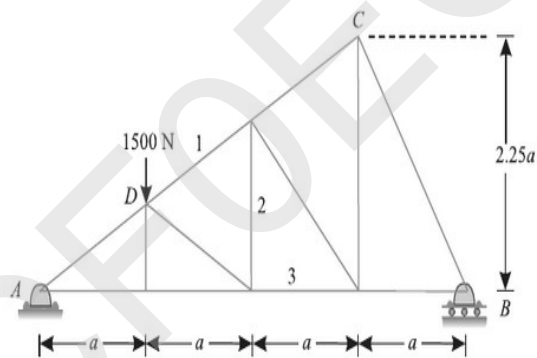


Figure 4

- 4 a) Determine the centroid of the shaded area of given figure 5.

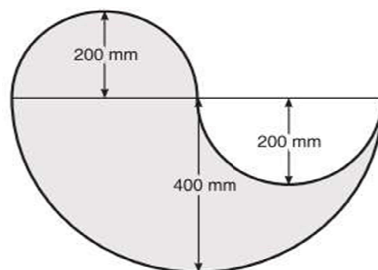


Figure 5

Or

Contd..3..

-3-

- b) Determine the moment of inertia of the section shown in figure 6 about its centroidal axis of a cast iron beam.

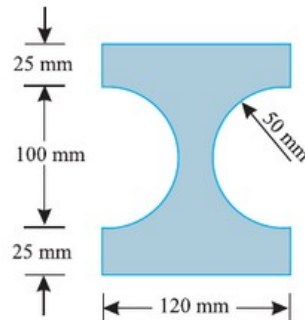


Figure 6

- 5 a) A particle moves along straight line. Its motion is represented by the equation $S=16t + 4t^2 - 3t^3$ where S is in meters and t in seconds. Determine
- Displacement, velocity and acceleration 2 seconds after start.
 - Displacement and acceleration, when velocity is zero. and
 - Displacement and acceleration, when acceleration is zero.
- b) Water drips from a faucet at the uniform rate of n drops per second. Find the distance 'x' between any adjacent drops as a function of time 't' that the trailing drop has been in motion. Neglect air resistance and assume constant acceleration $g=9.81\text{m/s}^2$
- OR
- c) A motor cyclist wants to jump over a ditch as shown in Figure 7. Find the necessary minimum velocity at A in km. p. hr. of the motor cycle. Also find the inclination and the magnitude of the velocity of the motor cycle just after clearing the ditch.

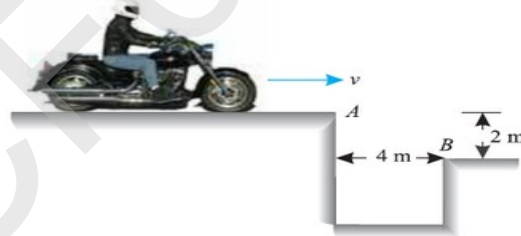


Figure 7

- 6 a) A weight $W=4450\text{N}$ is supported in a vertical plane by strings and pulleys arranged as shown in figure 8. If the free end A of the string is pulled vertically downward with constant acceleration $a=18\text{m/s}^2$. Find the tension 'S' in the string.

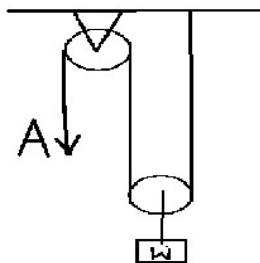


Figure 8

OR

Contd..4..

-4-

- b) A small car of weight W starts from rest at A and rolls without friction along the loop $ACBD$ as shown in figure 9. What is the least height h above the top of the loop at which the car can start without falling off the track at point B , and for such a starting position what velocity will the car have along a horizontal portion CD of the track? Neglect friction.

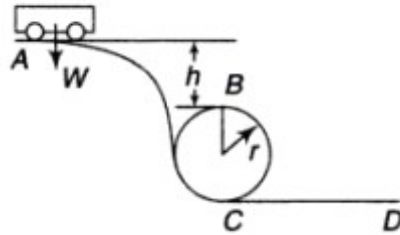


Figure 9

- 7 a) A truss hinged at A and supported on rollers at D is loaded as shown in figure 10. Find by any method the forces in all the members of the truss and mention the nature of forces

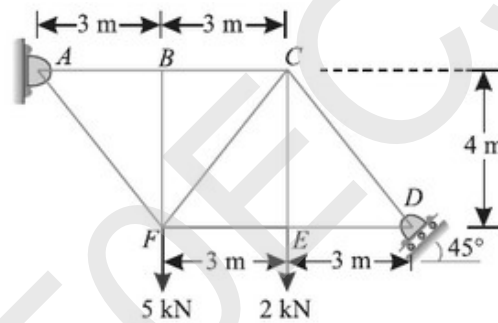


Figure 10

OR

- b) Two identical prismatic bars AB and CD are welded together in the form of a rigid T and suspended in vertical plane as shown in figure 11. Calculate the angle α that the bar AB will make with the vertical when a vertical load $F=44.5$ N is applied at B . the weight of the bar is $Q=22.25$ N

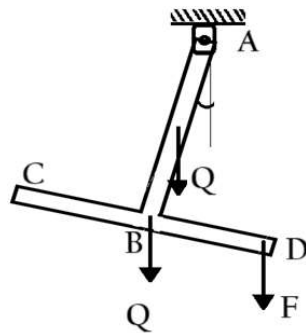


Figure 11

Contd..5..

- 8 a) Derive the relation between work and energy.
- b) A motorcycle and a rider of total mass 50 N travel in a vertical plane with constant speed 45 Kmph along the circular curve as shown in figure 12. Find the reaction exerted on the motorcycle by the track as it pushes the Crest C of the curve. At what point B on the vertical Curve, defined by the angle θ will the road reaction be zero? Take the radius of the curve as 500 m.

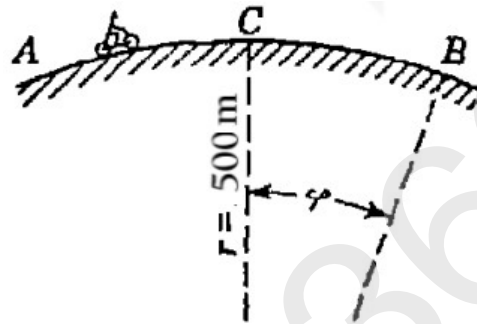


Figure 12

OR

- c) A small block starts from rest at A and slides down the inclined plane AB as shown in figure 13. What distance S along the plane BC will it travel before it coming to rest? The coefficient of kinetic friction between the block and either plane is $\mu = 0.3$. Assume that the initial velocity with which it starts to move along the plane BC is of the same magnitude as that gained in sliding from A to B.

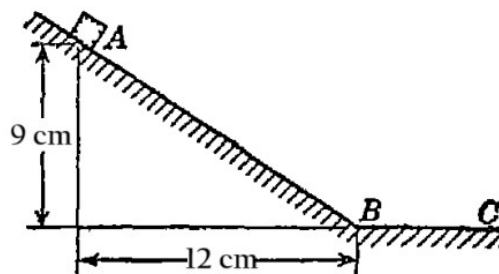


Figure 13

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FACULTY OF ENGINEERING AND TECHNOLOGY

B.Tech. (II-Semester) (CBCS) Examination

Programming for Problem Solving

Time: 3 Hours]

[Max. Marks: 70

Section – A (Marks: 10 x 1 = 10)

Answer all questions

- 1 a) What is Compiler?
- b) Write different types of number systems.
- c) What is operator?
- d) Show step by step evaluation of the following expression?
 $12 + 13/2*5\%4$
- e) Give example for nested loop.
- f) Differentiate between break and continue.
- g) Define pointer.
- h) Define string.
- i) List different parameter passing methods.
- j) What is recursion?

Section – B (Marks: 5 x 12 = 60)

Answer any Five questions

- 2 a) Draw the block diagram of computer and explain in detail.
(Or)
- b) Explain basic structure of a C program with an example program.
- 3 a) Discuss various datatypes in C language.
(Or)
- b) Explain arithmetic and relational operators with example programs.
- 4 a) Explain if, if...else, nested if...else statements with example programs.
(Or)
- b) Explain various loop statements. Write a program to find sum of digits of a given integer number.
- 5 a) Define an array. Explain different types of arrays with their syntax and examples.
(Or)
- b) Explain various string functions with example program.

Contd..2..

-2-

- 6 a) Define structure. Give its syntax. Write a program to implement a structure.
(Or)
b) Explain various storage classes in C.
- 7 a) Discuss various symbols used in flowcharts. Draw a flowchart to test whether the given number is even or odd.
(Or)
b) Write about conditional operator. Write a program to find greatest of two numbers using conditional operator.
- 8 a) What do you mean by function prototype? Write a program to find factorial of a given number using recursion.
(Or)
b) What is a file? Explain various file modes in C.

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FACULTY OF ENGINEERING AND TECHNOLOGY

B.Tech. (II-Semester) (CBCS) Examination

BASIC ELECTRICAL ENGINEERING

Time: 3 Hours]

[Max Marks: 70

Section – A (Marks: 10 x 1=10)

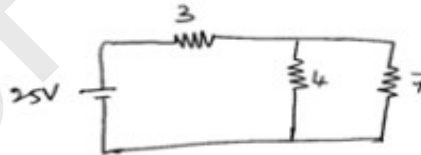
Answer all the questions.

- 1 a) State the Kirchhoff's Current law.
- b) Define principle node and mesh.
- c) What is the RMS value of Sinusoidal wave?
- d) Mention any two advantages of 3-phase circuit.
- e) Mention any two applications of a 3-phase Induction Motor.
- f) Why the rotor of the 3-phase squirrel cage Induction Motor is skewed.
- g) What are the applications of DC generator?
- h) Mention the speed control methods of the DC shunt motor?
- i) What is the necessity of earthing in domestic buildings?
- j) What is a MCB?

Section –B (Marks: 5 x 12 = 60)

Answer any five questions.

2. a) Using Thevenin's theorem, find the current through the 7Ω resistor, as shown in below figure. All resistances are in ohms.



(OR)

- b) State and Explain the Super Position Theorem with an example.
3. a) Define the following terms: i) Frequency ii) Peak factor, iii) Form factor, iv) Average value of an alternating quantity.
- b) A series RLC circuit consists of $R= 3 \text{ ohm}$, $L= 2\text{mH}$ and $C=0.4 \mu\text{F}$. Determine the resonant frequency.

(OR)

- c) Derive the relation between line and phase quantities of voltage and current for a delta connected system with a neat diagram.
4. a) Draw and explain the phasor diagram of single phase transformer on lagging power factor load.

(OR)

- b) What is a slip? Explain the Torque-slip characteristics of a 3-phase Induction motor.

Contd..2..

-2-

5. a) Derive the EMF equation of DC generator.
b) Explain the operating characteristics of DC motor.

(OR)

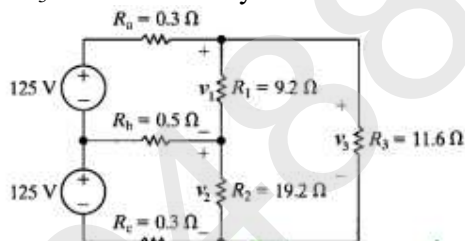
- c) Explain the construction and working principle of a DC Shunt motor.

6. a) What are the types of batteries? Explain them briefly.

(OR)

- b) Describe the operation of ELCB with its schematic diagram.

7. a) In the following given circuit shown in figure calculate (i) v_1, v_2, v_3 , and (ii) power delivered to R_1, R_2 and R_3 . Use mesh analysis.



(OR)

- b) Describe the constructional details of three phase slip ring induction motor.
c) A 50Hz,3-phase 4-pole Induction motor runs at 1440rpm. Find the slip speed, slip and rotor frequency.

8. a) Explain the operation of 1-phase transformer with equivalent circuit diagrams.

(OR)

- b) Calculate total energy consumed per day by the use of following loads:
i) 5 number of 40 W lights operated 5 hours per day
ii) 1 h.p. motor is operated 2 hours per day
iii) 1 k.W heater is operated 1 hour per day
iv) 1 computer is used for 6 hours per day with printer about 30 minutes.

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FACULTY OF ENGINEERING AND TECHNOLOGY
B.Tech. (II-Semester) (CBCS) Examination
ENGLISH

Time: 3 Hours]

[Max. Marks:70

Section A - (Marks: 5 x 2=10)

1 Answer all questions

- a) Why does the author ask his son to be courteous and polite to his classmates in “On the Conduct of Life” by *William Hazlitt*.
- b) What kind of Landscape is described on the first three stanzas in the poem ‘The Brook’ by *Alfred Tennyson*.
- c) Why do Girintza, Shultz and Vontieff want to kill the prince in ‘The Death Trap’ by *Saki*.
- d) Why did Chindu Yellama decide to dissolve her marriage?
- e) Mention three rules the author advocates in order to better one’s use of language in ‘Politics and the English language’ by *George Orwell*.

Section B - (Marks: 5 x 12=60)

Answer any **Five** questions

- 2 a) Describe the formation of New Words using root words from other languages with suitable examples.

(OR)

- b) (i) Give the **synonyms** of the following words:

- | | |
|----------------|---------------|
| (1) meticulous | (4) hazardous |
| (2) futile | (5) wreak |
| (3) seldom | (6) lucid |

- (ii) Give the **antonyms** of the following words:

- | | |
|---------------|---------------|
| (1) appear | (4) rude |
| (2) extempore | (5) recognise |
| (3) lenient | (6) logical |

- 3 a) ‘Punctuation provides clarity and organization to a written text’, Explain with Suitable examples.

(OR)

- b) Rewrite the following sentences as directed:

- (i) In spite of his riches, he is not happy. (Change into compound sentence)
- (ii) She is not only my classmate but also my neighbor. (Change into simple sentence)
- (iii) The boy saw the dog and ran away. (Change into complex sentence)
- (iv) When my parents settled in the city, they sent it for us. (Change into compound sentence)
- (v) The little puppy jumped in joy, when it saw its master. (Change into simple sentence)
- (vi) He was lazy, yet luck favoured him. Change into complex sentence)

Contd..2..

-2-

4 a) Rewrite the following sentences by correcting the italicized word.

- i) They *enjoys* watching Television.
- ii) Each of the cars *are* very-well-designed by the company.
- iii) All soldiers contributed *his* part in the war.
- iv) The old woman died *with* cancer.
- v) Most of the students *has* voted for Manu.
- vi) Neither Shakespeare nor Milton *belong* to Greece.

(OR)

b) Fill in the blanks with correct prepositions given in the brackets:

- i) Rahul is _____ Leave. (on, in)
- ii) The girls share the chocolates _____ themselves. (among, between)
- iii) Let's go to temple _____ foot. (on, by)
- iv) She was hiding _____ the table. (under, below)
- v) The title boy has been playing _____ one hour. (since, for)
- vi) Many foods _____ milk contain calcium. (beside, besides)

5 a) Describe your favourite National Leader.

(OR)

b) Name three techniques of writing more precisely.

6 a) Write an essay on "The role of the youth in nation building".

(OR)

b) Read the following comprehension and choose the right answer from the following:

Machines save time, and therefore people have plenty of Leisure today. Workers who stand for hours near a lathe or some other machine must surely have some means of relaxation at the end of the day. Machine Civilisation has provided various forms of entertainment for these hours of leisure. There is the radio, which helps people to listen to programmes of music, sports commentaries of talks. The cinema is another popular form of entertainment. Television combines the features of the radio and the cinema and brings live pictures from far – off corners of the world into our drawing rooms. Another way of spending leisure is to read books and magazines. Today books and magazines to suit all tastes are available in every important language of the world.

1. Name one more popular form of entertainment other than radio from the above paragraph:

- | | |
|-----------|-----------|
| a) Drama | b) Cinema |
| c) Sports | d) music |

2. Machine civilization has provided various form of _____ for the hours of leisure.

- | | |
|------------------|------------------|
| a) retirement | b) amusement |
| c) entertainment | d) enlightenment |

Contd..2..

3. Television combines the features of _____ and _____.
 - a) The books and the magazines.
 - b) The bags and the baggage.
 - c) The radio and the cinema.
 - d) The foods and the soft drinks.
4. In this paragraph, the word 'Lathe' means:
 - a) machine tool b) late
 - c) gardening d) bundle
5. The synonym for the word 'Civilisation' in the passage is :
 - a) decadence b) advancement
 - c) encouragement d) amusement
6. Write the antonym for the word 'Leisure' in the passage:
 - a) delay b) work
 - c) free d) silence

- 7 a) Make a Precis of the following passage:

Values and ethics form the fundamental building blocks of your personality. Values are certain principles that govern the way you conduct your life, while ethics are moral principles that determine. For instance, being kind to everyone irrespective of their social status, class or caste is a value, while not lying or indulging in cheating is ethical behavior. Both are tied together in that having a solid value system usually means leading and ethical life.

(OR)

- b) Fill in the blanks with verb in agreement with its subject:

- (i) The president and chief executive of the company _____ arrived.
- (ii) Your baggage _____ heavy.
- (iii) These spectacles _____ not mine.
- (iv) Everyone _____ finished their work.
- (v) Idli and sambar _____ my favourite breakfast.
- (vi) Either the president or the secretary _____ signed this document.

8. a) Find out the redundancies and rewrite the sentences correctly.

- (i) Don't reveal your PIN number.
- (ii) The patients condition is absolutely critical.
- (iii) The train will arrive at 6.00 am in the morning.
- (iv) The enemy was surrounded on all sides.
- (v) We are in a position to begin the meeting.
- (vi) The students revealed their future plans

(OR)

- b) Define introduction and conclusion and write introduction and conclusion paragraphs for different types of writing styles,

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FACULTY OF ENGINEERING AND TECHNOLOGY
B.Tech. (II-Semester) (CBCS) Examination
ENGINEERING GRAPHICS AND DESIGN

Time: 3 hours]

[Maximum Marks: 70

SECTION – A (Marks: 10 x 1 = 10)

I. Answer ALL questions.

- a) The internal angle of Regular pentagon is-----
- b) For drawing of small instruments, like watch parts, ----- scale is used.
- c) Right pyramids and cones are developed byline development method.
- d) A polyhedron is a solid bounded by.....surfaces called faces.
- e) Difference between the first and third angle projection.
- f) Isometric projection of a square is a.....
- g) What will be the locus of a point on a thread unwound from a cylinder.....?
- h) When a solid is cut by a section plane, inclined the base, the retained portion is called.....solid.
- i) In isometric projection, dimension lines are drawn parallel to.....
- j) What is the shortcut key of array command in CAD.....?

SECTION – B (Marks: 5 x 12 = 60)

Answer any **Five** questions

- 2 a) If 1 cm long line on a map represents a real length of 4 m. Calculate the R.F. and draw a diagonal scale long enough to measure up to 50 metres. Show a distance of 44.5 m on it.

OR

- b) A circle of 50 mm diameter rolls on the circumference of another circle of 175 mm Diameter and outside it. Trace the locus of a point on the circumference of the rolling circle for one complete revolution. Name the curve. Draw a tangent and a normal to the curve at a point 125mm from the centre of the directing circle.
- 3 a) A line PQ 100 mm long is inclined at 30° to the H.P. and at 45° to the V.P., its mid point is in the V.P. and 20mm above the H.P. Draw its projection, if its end P is in the third quadrant and Q in the first quadrant.

OR

- b) ABCD is a Rhombus having diagonal AC=60 mm and BD=40 mm and they are perpendicular to each other. The plane of the rhombus is inclined with the H.P. such that its top view appears to be square. The top view of AC makes 30° with the V.P., draw its projection and determine inclination of the plane with the H.P.

Contd..2..

- 4 a) A hexagonal pyramid of base side 30 mm and axis 60 mm has one of its slant edges on the H.P. and inclined at 45° to the V.P. Draw its projections when the base is visible.

OR

- b) A pentagonal pyramid of 30mm base edges and axis 70mm long is laying on one of its triangular faces on HP. Draw its projections, when the top view of the axis makes 20° with the VP.
- 5 a) Draw the Front view, Top view and Side view of the following fig: 1

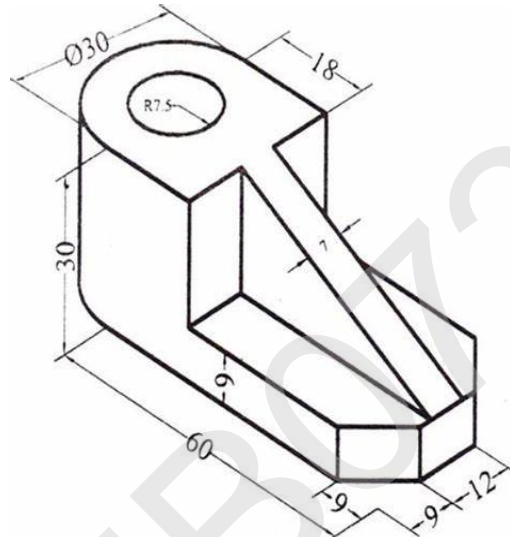


Figure 1

OR

- b) Convert the orthogonal projections into an isometric view of the following fig: 2

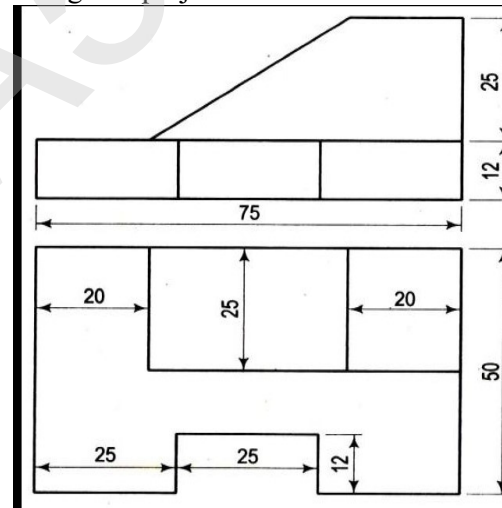


Figure 2

- 6 a) A cylinder of diameter of base 40mm and height 50mm is standing on its base on H.P. A cutting plane inclined at 45° to the axis of the cylinder passes through the left extreme point of the top base. Develop the lateral surface of the truncated cylinder.

OR

Contd..3..

-3-

- b) A Hexagonal pyramid of side of base 30mm and height 65mm is resting on its base in H.P. one of its base sides is parallel to V.P. it is cut by cutting plane which is parallel to H.P. and perpendicular to V.P. and passing at height of 45mm from its bottom. Draw the development of the surfaces.
- 7 a) A pentagonal pyramid has its base on the H.P and the edge of the base nearer the V.P, parallel to it. a vertical section plane, inclined at 45° to the V.P. cuts the pyramid at a distance of 6mm from axis. Draw the top view sectional front view and the auxiliary front view on an A.V.P parallel to the section plane, base of the pyramid 30 mm side axis 50 mm long.
- OR
- b) A circular plate of 60 mm diameter has a hexagonal hole of 20 mm sides, centrally punched. Draw the projections of the lamina when its surface is inclined at 30° to H.P and with two parallel sides of the hexagonal hole parallel to H.P and perpendicular to V.P.
- 8 a) Draw the projections of a circle of 75 mm diameter having the end A of the diameter AB in the H.P the end B in the V.P and the surface inclined at 30° to the H.P and 60° to the V.P.
- OR
- b) A vertical chimney of circular section of 400mm diameter is located on the rooftop sloping at 35° to the horizontal. If the shortest portion of the chimney is 300 mm height, then determine the shape of the sheet metal area from which the chimney can be made use 1:10 scale.

FACULTY OF ENGINEERING AND TECHNOLOGY

B.Tech. (II Semester) Examination

MATHEMATICS-II

(Common to all branches)

(CBCS)

Time: 3 Hours]

[Max. Marks: 70

Section A – (Marks: $10 \times 1 = 10$)

Answer all questions.

1. (a) Write a formula for (i) $L\{e^{at} \sin bt\}$ (ii) $L\{t^n\}$.
- (b) If $L\{f(t)\} = \bar{f}(s)$, then write a formula for $L\{t^n f(t)\}$.
- (c) Find the characteristic polynomial of $A = \begin{bmatrix} 3 & -1 \\ 2 & -4 \end{bmatrix}$.
- (d) Define rank of a matrix.
- (e) Form the partial differential equations from $Z = 2f(x^2 + y^2)$.
- (f) Solve: $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} = 0$.
- (g) State Cauchy-Riemann equations.
- (h) Define harmonic function.
- (i) Write Laurent series.
- (i) Define residue of a function.

Section B – (Marks: $5 \times 12 = 60$)

Answer any five questions.

2. (a) Find the Laplace transform of the following functions (i) $t \sin 2t$

$$(ii) F(t) \begin{cases} e^t & ; 0 < t \leq 1 \\ 0 & ; t > 1 \end{cases}$$

Or

- (b) Use Laplace transform techniques to solve $ty'' + 2y' + ty = \cos t$: $y(0) = 1$: $y'(0) = 0$.

[P.T.O.]

3. (a) Reduce the matrix $A = \begin{pmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & 2 \end{pmatrix}$ to its normal form and hence find the rank.

Or

- (b) Investigate the values of λ and μ so that the equations $2x + 3y + 5z = 9$; $7x + 3y - 2z = 8$; $2x + 3y + \lambda z = \mu$ have (i) no solution (ii) a unique solution (iii) an infinite number of solutions.

4. (a) Use Lagrange's method to solve the partial differential equation $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$.

Or

- (b) Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ with boundary conditions $u(x,0) = 3 \sin n\pi x$, $u(0,t) = 0$ and $u(1,t) = 0$, where $0 < x < 1, t > 0$.

5. (a) If $f(z)$ is an analytic function with constant modulus, then show that $f(z)$ is constant.

Or

- (b) Find the analytic function whose real part is $x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$.

6. (a) Apply Cauchy's Integral formula to evaluate $\int_c \frac{e^{2z}}{(z+1)^4} dz$, where c is the circle $|z| = 2$.

Or

- (b) Show that $\int_0^{2\pi} \frac{\cos 2\theta d\theta}{1 - 2a \cos \theta + a^2} = \frac{2\pi a^2}{1 - a^2}; (a^2 < 1)$.

7. (a) By using convolution theorem, to evaluate $L^{-1} \left\{ \frac{S}{(s^2 + a^2)^2} \right\}$.

Or

- (b) Find the eigen values and corresponding eigen vectors of the matrix $\begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$.

8. (a) Use Charpit's method to solve the partial differential equation $(p^2 + q^2)y - qz = 0$.

Or

- (b) Find the transformation which maps the points $-1, i, 1$ of the z -plane onto $1, i, -1$ of the w -plane respectively.