

JALPAIGURI GOVERNMENT ENGINEERING COLLEGE
[A GOVERNMENT AUTONOMOUS COLLEGE]
JGEC/B.TECH/ CIVIL ENGINEERING/ PC- CE301/ 2024-25
2024
SURVEYING & GEOMATICS

Full Marks: 70

Times: 3 Hours

The figures in the margin indicate full marks.
Candidates are instructed to write the answers in their own words as far as practicable.

GROUP-A
[OBJECTIVE TYPE QUESTIONS]

Answer *all* questions

- | | | |
|----|---|--------|
| | | 5x2=10 |
| 1. | What is the difference between pushbroom and whiskbroom scanning systems in remote sensing? | 2 |
| 2. | What is post-classification smoothing in digital image processing, and why is it necessary? | 2 |
| 3. | Define parallax angle in stereoscopic vision and its significance in photogrammetry. | 2 |
| 4. | Why are baseline corrections necessary in triangulation surveys? | 2 |
| 5. | What is contour gradient? What is Transiting of a theodolite? | 1+ |

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

Answer any *four* questions

- | | | |
|----|--|-----------|
| | | 4x15 = 60 |
| 6. | (i) Discuss the characteristics of IRS, Landsat, and Sentinel sensors and their applications. | 5 |
| | (ii) Explain the working principle of a terrestrial laser scanner and its applications in 3D mapping. | 5 |
| | (iii) An aerial photograph with a focal length of 150 mm captures a ground area. If the flying height is 2000 m above ground level, calculate the scale of the photograph. | 5 |
| 7. | (i) A dumpy level is set up between points A and B. The staff readings at A, B, and an intermediate point C are as follows: Staff reading at A = 1.250 m, Staff reading at C = 0.850 m, Staff reading at B = 2.350 m. The reduced level (RL) of point A is 120.750 m.
Calculate: a) The reduced levels of points C and B. b) The gradient of line AB. | 5 |
| | (ii) Explain the difficulties encountered during levelling operations in hilly areas. | 2 |
| | (iii) Discuss the principles and precautions of differential levelling. | 3 |
| | (iv) Describe the elements of a compound curve and their practical applications in highway design. | 5 |
| 8. | (i) Discuss the methods of solving two-point and three-point problems in plane table surveying. | 5 |
| | (ii) Explain the network design in triangulation with a focus on signal requirements. | 5 |
| | (iii) In a triangulation network, two angles are measured as $45^{\circ}30'$ and $60^{\circ}15'$, and the baseline is 500 m. Compute the third angle and other sides using the sine rule. | 5 |
| 9. | (i) Explain the concept of the atmospheric window with a neat sketch and its significance in remote sensing. | 3 |
| | (ii) Identify and explain the factors that determine the transparency of the atmosphere in different wavelength regions. | 2 |
| | (iii) Which parts of the electromagnetic spectrum correspond to atmospheric windows commonly used in remote sensing applications? | 2 |
| | (iv) Discuss the importance of these windows in:
a. Satellite-based remote sensing of Earth's surface.
b. Infrared imaging for thermal mapping. | 2+ |
| | (v) Explain how the presence of water vapor and other atmospheric constituents impacts the effectiveness of these windows. | 2 |
| | | 4 |
| 10 | (i) Write short notes on the following:
a. Terrestrial laser scanner. | 2 |
| | | 2 |

b. Principle of Differential GPS.

2

c. Distomats.

2

d. Auto-level.

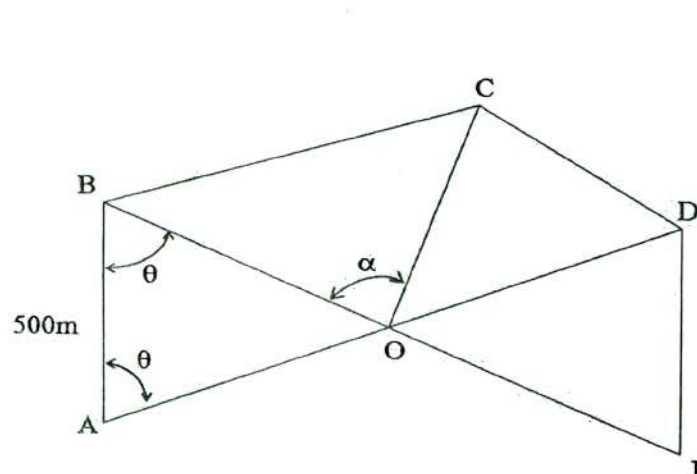
(ii) For the following theodolite traverse, find the length of DE so that A, E, F may be in the same straight line.

Line	Length (m)	Reduced Bearing
AB	200	S84°30'E
BC	100	N75°18'E
CD	80	N18°45'E
DE	?	N29°45'E
EF	150	N64°10'E

7

11

(i) Given the polygon shown in the figure which is a part of a triangulation system. The straight lines BE and AD are equal in length and point O is located at their midpoint. The azimuth of line BC is 255 degrees. If the angle $\theta = 70$ degrees and length AB is equal to 500 meters, determine the length of CD. Note that $\alpha = 90$ degrees.



7

(ii) Classify

the triangulation system and discuss them briefly with neat sketches.

the

4

(iii) Describe the different rules used for Adjustment of plane triangle with the help of sketches.

4

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JGEC/B.TECH/ CE/ PC-CE302/ 2024-25
2024
ENGINEERING GEOLOGY

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Candidates are instructed to write the answers in their own words as far as practicable.
Assume data reasonably if not supplied

Full Marks: 70

Times: 3 Hours

GROUP-A
[OBJECTIVE TYPE QUESTIONS]

Answer *all* questions

- | | |
|--|--------|
| | 5×2=10 |
| 1. Define Exfoliation and watershed. | 1+1 |
| 2. Define slump w.r.t. landslides. | 2 |
| 3. What is Sand dune Stabilization. | 2 |
| 4. Define streak and luster. | 1+1 |
| 5. Differentiate between infiltration and percolation. | 2 |

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

Answer any *four* questions

- | | |
|-----|--|
| | 4×15 = 60 |
| 6. | i) What is Diapheneity? Classify minerals based on diapheneity with suitable examples. 1+4
ii) What is Habit of mineral? State different types of habits of mineral with suitable examples. 1+4
iii) Briefly describe Dendritic and Trellis drainage pattern with proper sketches. 2×2.5 |
| 7. | i) Briefly describe some potential sources of groundwater contamination. 5
ii) Define porosity, permeability, storativity, transmissibility, specific retention. 5
iii) Define Remote sensing and GIS. 2
iv) What are the principles of remote sensing. 3 |
| 8. | i) Describe the stages of remote sensing with proper sketch. 7
ii) Define aquifer, aquiclude, aquitard, aquifuge with examples. 4
iii) Briefly describe Horizontal Profiling procedure for the resistivity test of soil. 4 |
| 9. | i) State the types of landslides. Briefly describe the preventative measures of landslides. 3+5
ii) Briefly describe different types of clastic rocks with examples. 5
iii) Differentiate between artesian and non-artesian wells. 2 |
| 10. | i) Briefly describe about different types of earthquake waves. 3
ii) Briefly describe different types of metamorphism with examples. 5
iii) Briefly describe remedial measures of seawater intrusions into coastal aquifers. 3
iv) Briefly describe different types of fractures of mineral. Give examples. 4 |
| 11. | i) Briefly describe the processes of Chemical Weathering. 4
ii) Briefly describe different types of igneous rocks with examples. 4
iii) How good are metamorphic rocks as aquifers. 2
iv) What are the colours and the streaks of chalcopryrite, muscovite mica and dolomite. 3
v) Define diagenesis. 2 |

ENGINEERING MECHANICS

Times: 3 Hours

Assume data reasonably if not supplied.

[OBJECTIVE TYPE QUESTIONS]

$$5 \times 2 = 10$$

1. Define Law of Transmissibility of force with suitable diagram.
2. Explain the following terms are used in Engineering Mechanics: Continuum, Rigid Body, Particle and Momentum.
3. Explain the terms Limiting friction and Coefficient of friction
4. Distinguish between distance and displacement, kinematics and kinetics.
5. Define Couple and list the properties of couple of forces.

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

$$4 \times 15 = 60$$

6. i) Explain the term Free Body Diagram (FBD). Write down all the steps involved for drawing FBD.
 ii) A sphere weighing 250 N is tied to a smooth wall by a string as shown in Fig. 6.1. Draw the FBD and find the tension T in the string and the reaction R from the wall using Lami's theorem.
 iii) The resultant of two forces one of which is 4 times the other is 400 N. When the direction of smaller force is reversed, the resultant is 200N. Determine the two forces and the angle between them using Parallelogram law of forces.

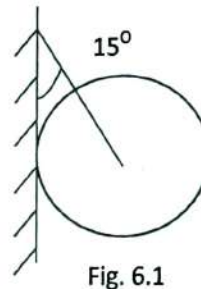


Fig. 6.1

7.
 - i) Distinguish between centroid and center of gravity.
 - ii) Explain the terms Moment of Inertia, Polar moment of Inertia and Radius of Gyration.

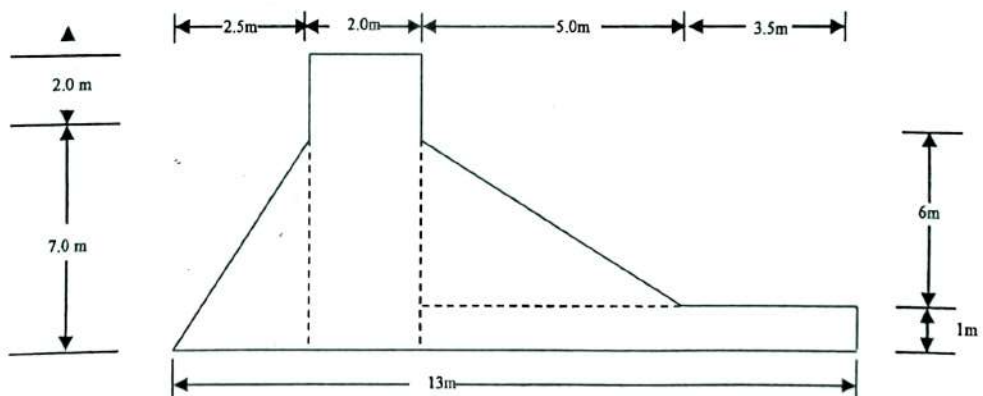
$$1+3+5+6=15$$


Fig. 7.1

- iii) Determine the Centroid of the section of Concrete dam shown in Fig.7.1
 iv) In Fig 7.1 Isolate the section as shown by dotted line and find the moment of inertia of each section separately at centroidal axis.

3+2+10=15

8. i) State the assumptions made in the analysis of trusses.
 ii) Define Perfect truss and draw the simplest perfect truss.
 iii) In fig 8.1 of the truss find the Zero force members and find the magnitude and nature of forces in the member IG and JH using method of sections.

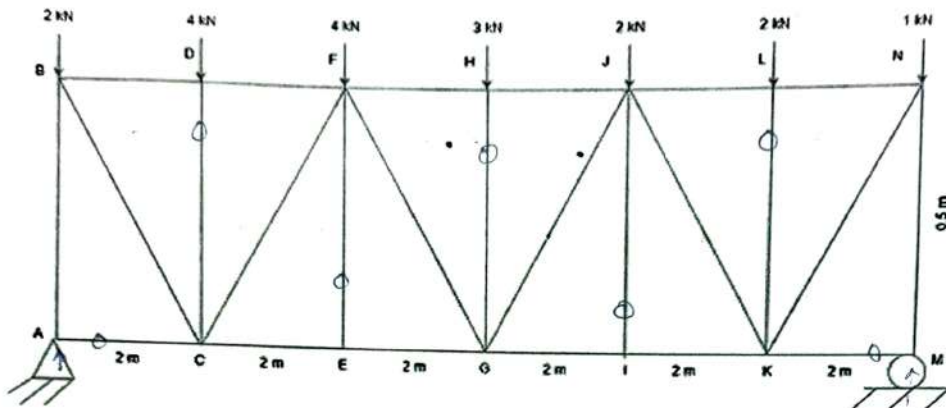


Fig. 8.1

9. i) Define virtual work method and give expressions for work done by a force and a moment.
 ii) A pile hammer, weighing 25 kN drops from a height of 600 mm on a pile of 9.5 kN. How deep does a single blow of hammer drive the pile if the resistance of the ground to pile is 160 kN?
 iii) In a police investigation of tyre marks, it was concluded that a car while in motion along a straight level road skidded for a total of 80 meters after the brakes were applied. If the coefficient of friction between the tyres and pavement is estimated as 0.5, what was the probable speed of the car just before the brakes were applied?
10. i) State and explain D' Alembert's Principle.
 ii) The amplitude of a particle in simple harmonic motion is 0.90m and the period is 1.5 seconds. Determine the maximum velocity and the maximum acceleration.
 iii) A pressure tank issues water at A with a horizontal velocity u as shown in Fig. 10.1. For what range of values u , water will be entering the opening BC.

5+5+5=15

4+5+6=15

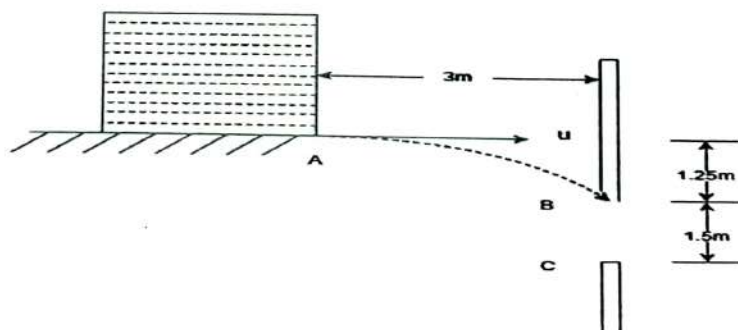


Fig. 10.1

- 11 i) A block weighing 650N just starts moving down a rough inclined plane when supported by a force of 300N acting parallel to the plane in upward direction. The same block is on the verge of moving up the plane when pulled by a force of 400N acting parallel to the plane. Find the inclination of the plane and coefficient of friction between the inclined plane and block. 5+4+6=15
- ii) A body is projected at an angle such that its horizontal range is 2.5 times the maximum height. Find the angle of projection.
- iii) Compute the moment of inertia of the channel section shown in fig. 11.1 about centroidal axes x-x and y-y. All dimensions are in mm.

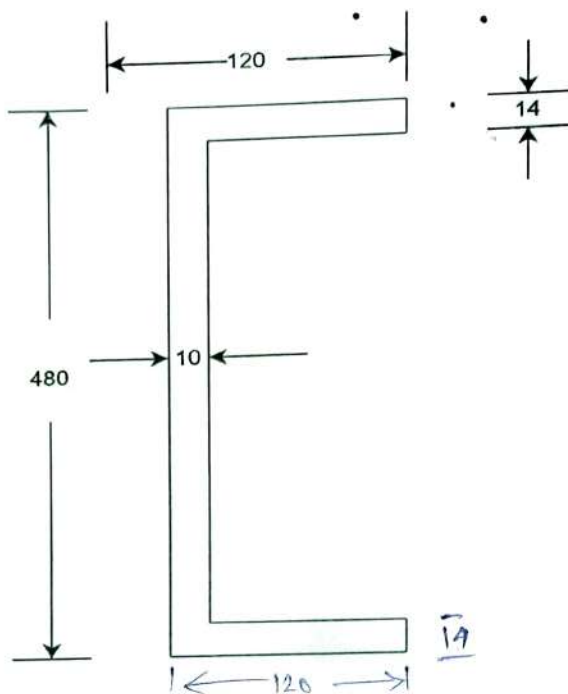


Fig. 11.1

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2024

FLUID MECHANICS & HYDRAULIC MACHINES

The figures in the margin indicate full marks.

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Assume data reasonably if not supplied

Full Marks: 70

Times: 3 Hours

GROUP-A
[OBJECTIVE TYPE QUESTIONS]

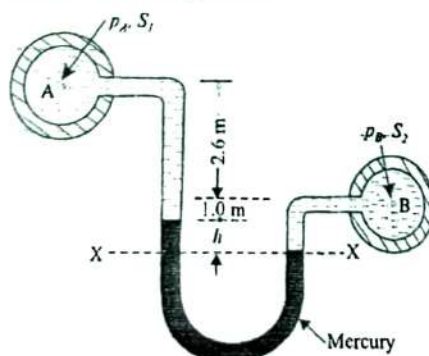
Answer **all** questions

- | | |
|--|--------|
| 1. Define steady non-uniform flow and unsteady uniform flow. | 5x2=10 |
| 2. Discuss the practical applications of Bernoulli's equation in various fields. | 1+1 |
| 3. Write expressions of surface tension for liquid droplet and hollow bubble. | 2 |
| 4. Define manometric efficiency and mechanical efficiency for centrifugal pump. | 1+1 |
| 5. Classify turbines according to the direction of flow through the runner. | 2 |
| | 2 |

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

Answer any **five** questions

- | | |
|---|-----------|
| 6. i) A Newtonian fluid is filled in the clearance between a shaft and a concentric sleeve. The sleeve attains a speed of 55 cm/s, when a force of 43 N is applied to the sleeve parallel to the shaft. Determine the speed if a force of 280 N is applied. | 5x12 = 60 |
| ii) Find out the minimum size of a glass tube that can be used to measure water level if the capillary rise in the tube is restricted to be 1.9 mm. Consider surface tension of water in contact with air as 0.073575 N/m. | 4 |
| iii) The discharge through a weir is 2.8 cumec. Find the discharge through the model of the weir if horizontal dimension of model = (1/50) the horizontal dimension of the prototype and vertical dimension of model = (1/15) the horizontal dimension of the prototype. | 4 |
| 7. i) A rectangular plane surface 2.8 m wide and 4.2 m deep lies in water in such a way that its plane makes an angle of 35 degree with free surface of water. Determine the total pressure force and position of centre of pressure, when the upper edge is 2.8 m below the free surface. | 7 |
| ii) The velocity field in a fluid medium is given by $V = 3x^2yz\mathbf{i} + 5y^2z\mathbf{j} + (7xy+2t)\mathbf{k}$ | 1+3+1 |
| Find the magnitudes and directions of i) translational velocity, ii) rotational velocity, and iii) the vorticity of a fluid element at (2, 3, 5) and at time $t = 3$. | |
| 8. i) Figure shows a U-tube differential manometer connecting two pressure pipes at A and B. The pipe A contains a liquid of specific gravity 1.85 under a pressure of 140 kN/m ² . The pipe B contains a liquid of specific gravity 0.94 under a pressure of 230 kN/m ² . Find the difference of pressure measured by mercury as fluid filling U-tube. | 4 |



- ii) The internal diameter of the ring is d , the rotational speed is N , density is ρ , dynamic viscosity is μ , surface tension is S , specific weight of the oil is w . Using Buckingham's π -theorem, obtain an expression for the discharge Q consumed by an oil ring. 8
9. i) Discuss the effect of metacentric height on the equilibrium of a floating body. 2
 ii) Find the acceleration components at a point $(2,1,1)$ and $t=5\text{sec}$ for the following flow field. $u = 4x^2y^3 + 6y^2z^2 + zt^2 + 5t$, $v = -3xty + 5yz^3 - 7xzt$, $w = -1.5z^2x + 7tz - 3tx$ 6
 iii) The velocity potential function for a flow is given by $\Phi = 7(x^2 - y^2)$. Calculate the velocity components at point $(1,3)$. Also determine stream function for the flow. 4
10. i) Differentiate between Lagrangian method and Eulerian method in fluid flow. 2
 ii) State time expressions for gradual and sudden closure of the valve. 2
 iii) A jet of water having a velocity of 14.5 m/s strikes a curved vane which is moving with a velocity of 4.5 m/s . The vane is symmetrical and is so shaped that the jet is deflected through 120° . Find the angle of the jet at inlet of the vane so that there is no shock. What is the absolute velocity of the jet at outlet in magnitude and direction and the work done per unit weight of water. 3+4+1
11. i) Three pipes of 460 mm , 420 mm , 650 mm diameter have lengths of 220 m , 320 m , and 260 m respectively. They are connected in series to make compound pipe. The ends of this compound pipe are connected with reservoirs whose difference of water level is 18 m . Coefficient of friction for the pipes are 0.004 , 0.005 , 0.003 respectively. Determine the discharge through the compound pipe. Consider all possible major and minor losses. 7
 ii) A horizontal venturimeter with inlet diameter 22.2 cm and throat diameter 10.5 cm is used to measure the flow of oil of specific gravity 0.89 . The discharge of oil through venturimeter is 65 lit/s . Find the reading of the oil-mercury differential manometer. Take $C_d = 0.82$. 5
12. i) An oil of viscosity 0.18 Ns/m^2 and relative density 0.95 is flowing through a circular pipe of diameter 60 mm and of length 360 mm . The rate of flow of fluid through the pipe is 3.9 lit/s . Find the pressure drop in length of 350 m and also the shear stress at the pipe wall. 6
 ii) A syphon of diameter 210 mm connects two reservoirs having a difference in elevation of 14.5 m . The total length of the syphon is 630 m and the summit is 4.2 m above the water level in the upper reservoir. If separation takes place at 2.75 m of water absolute, find the maximum length of syphon from upper reservoir to summit. Take $f = 0.0035$ and atmospheric pressure = 10.3 m of water. 6

JALPAIGURI GOVERNMENT ENGINEERING COLLEGE
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JGEC/B.TECH/CIVIL/MC-CE301/ 2024-25
2024
ENERGY AND ENVIRONMENTAL SCIENCE

Full Marks: 70

Times: 3 Hours

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Candidates are instructed to write the answers in their own words as far as practicable.

GROUP-A
[OBJECTIVE TYPE QUESTIONS]

Answer *all* questions

5x2=10

1. Define disaster management. Name some of the natural disasters.
2. What is ecological succession? Mention their types.
3. What are the different sources of solid waste?
4. What are the biotic components of an ecosystem? Name them.
5. Define energy with its forms.

2
2
2
2
2

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

Answer any *four* questions

4x15 = 60

6. Define ecosystem. Describe the type, characteristic feature, structure and functions of aquatic ecosystem.
7. i) Explain the sources, causes, effects and control measures of air pollution.
ii) How soil pollution can be minimised?
8. i) Write notes on cyclone and earthquake.
ii) What are the different methods of solid waste disposal?
9. i) Explain how noise pollution can be controlled?
ii) What are the causes of thermal pollution?
10. i) What are in situ and ex situ conservation of biodiversity?
ii) Explain the various threats to biodiversity.
11. i) Discuss the causes and effects of ozone layer depletion and acid rain.
ii) What is Wild Life Protection Act?
12. i) Write a note on Bhopal disaster and Chernobyl disaster.
ii) What are the different types of renewable energy resources? Explain in detail.

4+1
1
9
6
7
8
7
8
6
8
7

JALPAIGURI GOVERNMENT ENGINEERING COLLEGE
[A GOVERNMENT AUTONOMOUS COLLEGE]
JGEC/B.TECH/CE/BS-M (CE) 301/2024-25
2024
MATHEMATICS - III

Full Marks: 70

Times: 3 Hours

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GROUP-A
[OBJECTIVE TYPE QUESTIONS]

Answer *all* questions

5 × 2 = 10

1. Show that the number of vertices of odd degree in a graph is even. 2
2. Does there exist a simple graph with five vertices having degrees 2, 2, 4, 4, 4? Justify. 2
3. Form a partial differential equation by eliminating the function f from $z = xf\left(\frac{y}{x}\right)$. 2
4. Find the Fourier Transform of $f(x) = e^{-|x|}$. 2
5. Show that $P(AB) \geq P(A) + P(B) - 1$. 2

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

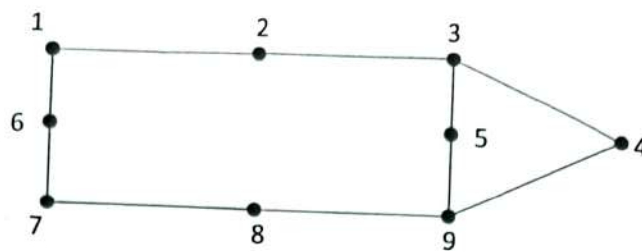
Answer any *five* questions

12 × 5 = 60

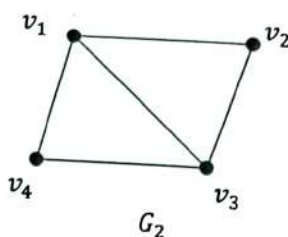
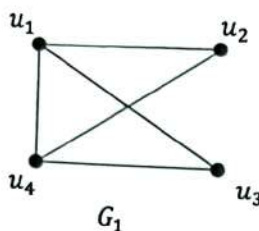
6. i) Find $L\left\{\frac{\sin at}{t}\right\}$. 4
 ii) Find the Laplace transform of f defined by $f(t) = \begin{cases} 0, & 0 \leq t < \pi \\ \sin t, & \pi \leq t < 2\pi \end{cases}$ with $f(t + 2\pi) = f(t)$ 4
 iii) Find $L^{-1}\left\{\frac{3s+1}{(s-1)(s^2+1)}\right\}$ 4
7. i) Find $L\{f(t)\}$ where $f(t) = t^2 \sin bt$. 3
 ii) Find the Fourier transform of $f(x)$ defined by $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases} [a > 0]$ 1+4
 Hence evaluate $\int_{-\infty}^{\infty} \frac{\sin pa \cos px}{p} dp$
 iii) Find the function $f(x)$ whose Fourier sine transform is $\frac{e^{-ap}}{p}, a > 0$ 4
8. i) Find the general solution of the following PDE : 4

$$x(y^2 - z^2)p + y(z^2 - x^2)q = z(x^2 - y^2)$$

 ii) Solve $(D^2 - DD')z = \sin x \sin 2y$ 4
 iii) Solve the PDE $(x^2 D^2 - y^2 D'^2 + xD - yD')z = \log x$ 4
9. i) Define a bipartite graph and a complete bipartite graph. Determine whether the following graph is bipartite or not. Give the bipartition sets or explain why the graph is not bipartite. 2+2

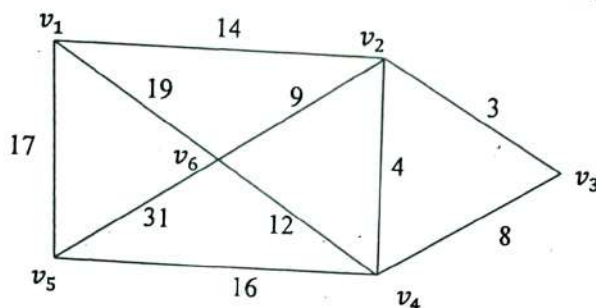


(ii) Find the adjacency matrices of the graphs G_1 and G_2 (given below) :



Examine whether the graphs are isomorphic or not.

10. (i) Show that a connected graph with n vertices and $(n - 1)$ edges is a tree. 4
 (ii) If a graph G has exactly two vertices of odd degree, show that there must be a path joining these two vertices. 4
 (iii) Use Kruskal's algorithm to find the minimal spanning tree in the graph G given below : 4



11. (iii) Define a binary tree. Find the number of pendant vertices in a binary tree. 1+3
 i) Solve the initial-value problem (by Laplace transform) : 4

$$\begin{cases} \frac{d^2 y}{dt^2} + 9y = 6 \cos 3t \\ y(0) = 2, y'(0) = 0 \end{cases}$$

- ii) Use the method of separation of variables to solve :

$$\frac{\partial^2 y}{\partial t^2} = a^2 \frac{\partial^2 y}{\partial x^2}$$

subject to

Boundary Conditions: $y(0, t) = 0, y(L, t) = 0$

Initial Conditions: $y(x, 0) = f(x)$ and $\frac{\partial y(x, 0)}{\partial t} = 0$.

(a) A discrete random variable X has the following probability mass function

$X=x$	1	2	3	4	5	6	7
$P(X=x)$	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2+k$

1+1+1+2+1

- Determine the constant k
- Evaluate $P(3 < X \leq 6)$
- Find the minimum value of x so that $P(X \leq x) > \frac{1}{2}$
- Obtain the distribution function $F(x)$
- Find mean of X .

(b) Three urns contain respectively 1 white and 2 black balls, 2 white and 1 black balls, 2 white and 2 black balls. One ball is transferred from the first to the second urn, then one ball is transferred from the second to the third urn, finally one ball is drawn from the third urn. Find the probability that the ball drawn is white.

5

13. (a) Determine the value of the constant k such that $f(x)$ defined by

$f(x) = \begin{cases} kx(1-x), & 0 < x < 1 \\ 0, & \text{elsewhere} \end{cases}$ is a probability density function. Find the corresponding distribution function and $P(X > \frac{1}{2})$.

2+2+2

(b) The length of bolts produced by a machine is normally distributed with parameter $m = 4$ and $\sigma = 0.5$. A bolt is defective if its length does not lie in the interval $(3.8, 4.3)$. Find the percentage of defective bolt produced by the machine.

6

[Given: $\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{0.6} e^{-\frac{t^2}{2}} dt = 0.7257$, $\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{0.4} e^{-\frac{t^2}{2}} dt = 0.6554$.]

JALPAIGURI GOVERNMENT ENGINEERING COLLEGE
[A GOVERNMENT AUTONOMOUS COLLEGE]
JGEC/B.TECH/ CE/BS-CE301/ 2024-25

BIOLOGY FOR ENGINEERS

Full Marks: 70

Times: 3 Hours

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GROUP-A

[OBJECTIVE TYPE QUESTIONS]

Answer *all* questions

[5X2=10]

1. Write about Chargaff rule.
2. What do you mean by amino acid pool?
3. Differentiate between the exergonic and endergonic reaction?
4. What is K_{eq} ?
5. Write about two characteristics of genetic code?

GROUP-B

[LONG ANSWER TYPE QUESTIONS]

Answer any *four* questions

[15X4=60]

1. Describe the ultramicroscopic structure of plant cells with a suitable diagram. (15)
2. Describe about the dihybrid cross experiment of Mendel along with a suitable illustration. (15)
3. Describe the classification of carbohydrates with the suitable examples. (15)
4. Describe three physical and three chemical properties of protein. Write about the various types of enzyme inhibition along with the suitable graphs. (6+9=15)
5. Describe the various processes of sterilization. Describe about multiple allele with respect to the human blood group. (10+5=15)
6. Classify various types of lipids. Write about the characteristics features of RNA with the help of suitable diagram? (10+5=15)