

(Pages : 4)

L – 3550

Reg. No. :

Name :

First Semester B.Sc. Degree Examination, August 2021

First Degree Programme under CBCSS

Statistics

Complementary Course for Mathematics

ST 1131.1 : DESCRIPTIVE STATISTICS

(2018 – 2019 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer all questions. Each question carries 1 mark.

1. What is a Sampling Frame?
2. Define the term Population.
3. Name any two graphical representation of data.
4. What is Central tendency?
5. Define Partition values.
6. Define r^{th} raw moment of a set of observations.
7. What is the measures of skewness in terms of moments?
8. Who introduced the term Regression?
9. What is the angle between the lines of regression when $r = 0$?
10. If the correlation between the two variables is negative then what is the sign of the regression coefficient of y on x ?

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Answer any **eight** questions. Each question carries **2** marks.

11. What is a sample survey? In what respects is it superior to a census survey?
12. Distinguish between probability and non-probability sampling.
13. Define systematic sampling.
14. Express Harmonic mean in terms of geometric mean and arithmetic mean.
15. Explain Mean deviation.
16. Explain the positions of mean, median and mode in symmetric distribution and skewed distribution.
17. What do you mean by raw and central moments?
18. In a frequency distribution the coefficient of skewness based on quartiles is 0.6. If the sum of the upper and lower quartiles is 100 and the median is 38, find the value of the upper quartiles.
19. What is Scatter diagram?
20. What are the properties of the regression coefficients?
21. What is the principle of least squares?
22. Write the normal equation for fitting a curve of the form $y = ae^{bx}$.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. Each question carries **4** marks.

23. What is a simple random sample? Mention the various methods of drawing a random sample.
24. Distinguish between sampling and non-sampling errors. Explain various sources of non-sampling errors.

25. Briefly explain the construction of a histogram with example.
26. A sample of 35 values has mean 80 and standard deviation 4. A second sample of 65 values has mean 70 and standard deviation 5. Find the standard deviation of the combined sample of 100 values.
27. The mean of 5 items of an observation is 4 and the variance is 5.2. If three of the five items are 1, 2 and 6. Find the other two.
28. What is Kurtosis? How does it differ from skewness?
29. Derive the formula for Spearman's Rank Correlation coefficient.
30. Calculate :
- (a) The regression equation of X on Y and Y on X from the following data :
- (b) Estimate X when $Y = 20$.

$X:$	10	12	13	17	18
$Y:$	5	6	7	9	13

31. Explain the fitting of a curve of the form $y = a + bx$.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. Each question carries **15** marks.

32. The following table gives the egg production during a year at a poultry farm :

No. of eggs :	0-29	30-59	60-89	90-119	120-149
No. of hens :	3	4	12	33	69
No. of eggs :	150-179	180-209	210-239	240-269	270-299
No. of hens :	92	50	25	11	1

Represent the above frequency distribution graphically. Also draw the ogives and estimate Median value.

33. Calculate the arithmetic mean and the median of the frequency distribution given below. Hence calculate the mode using the empirical relation

Classes :	130-134	135-139	140-144	145-149	150-154	155-159	160-164
f:	5	15	28	24	17	10	1

34. Fit a parabola to the following data :

x :	1	2	3	4	5	6	7	8	9
y :	2	6	7	8	10	11	11	10	9

Estimate y when $x = 4.5$.

35. Ten competitors in a beauty contest are ranked by three judges in the following order :

I Judge :	1	5	4	8	9	6	10	7	3	2
II Judge :	4	8	7	6	5	9	10	3	2	1
III Judge :	6	7	8	1	5	10	9	2	3	4

Use Rank correlation to discuss which pair of judges have the nearest approach to common tastes in beauty.

(2 × 15 = 30 Marks)

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L – 3553

Reg. No. :

Name :

First Semester B.Sc. Degree Examination, August 2021

First Degree Programme under CBCSS

Physics

Complementary Course for Mathematics

PY 1131.1: MECHANICS AND PROPERTIES OF MATTER

(2018–19 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions in one or two sentences. Each question carries 1 mark:

1. State parallel axis theorem.
2. What do you mean by neutral surface of a beam?
3. Write an expression for geometrical moment of inertia.
4. What is bending moment?
5. Define rigidity modulus.
6. Write down the expression to find excess pressure inside a spherical drop and explain the terms.
7. What you mean by viscosity?

P.T.O.

8. Write down the differential of simple harmonic motion and explain the terms.
9. Write an expression to find intensity of progressive wave and explain the terms.
10. Write the general equation of plane progressive wave.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions not exceeding in a paragraph. Each question carries **2** marks:

11. Draw the variation of potential and kinetic energy with displacement from mean position for a particle undergoing simple harmonic motion.
12. Why shaft of rotatory machineries are made of hollow cylinders.
13. Even though lava is highly viscous, it flows rapidly. Why?
14. What you mean by flexural rigidity.
15. State and explain simple harmonic motion.
16. What are the limitations of Poiseuille's formula.
17. Obtain an expression for average potential energy of a particle undergoing simple harmonic motion.
18. Briefly explain about compound pendulum.
19. Briefly discuss about spherical wave.
20. What you mean by zero point energy of molecule.
21. Derive an expression to find time period of torsion pendulum.
22. What is coefficient of viscosity.

(8 × 2 = 16 Marks)

SECTION – C

Answer any six questions. Each question carries 4 marks:

23. Find the angular momentum of the particle with rotational kinetic energy of 20 joules. Its angular momentum coincides with the axis of rotation and its moment of inertia about the axis is 0.1 kgm^2 .
24. Find the moment of inertia of uniform rectangular lamina of length l and breadth b about an axis perpendicular to its plane and passing through the center of mass.
25. A bar of length 1.2 m, breadth 3 cm and thickness 4 mm is used as cantilever. When a load of 0.25 kg is attached to the free end depression at free end is 1 cm. Calculate the young's modulus of the material.
26. Calculate the couple required to twist one end of wire with length 1 m and radius 1.5 mm through an angle 45° by keeping other end fixed. Rigidity modulus of the wire is given by $5 \times 10^{10} \text{ Nm}^{-2}$.
27. What would be the pressure inside a small air bubble of radius 0.1 mm situated just below the surface of water? Surface tension of water is 0.072 N/m and atmospheric pressure is 101300 N/m^2 .
28. Calculate the volume of water flowing per second through a tube of 0.1 cm diameter and 40 cm length. The pressure applied is 2000 N/m^2 . The coefficient of viscosity of water is 0.00089 SI unit.
29. A particle is moving in simple harmonic motion. Its velocity has the value 3 m/s and 2 m/s when it is at distance 1 m and 2 m from mean position respectively. Find the time period of oscillation.
30. A solid cylinder of radius 5 cm is suspended by a vertical wire as a pendulum. Axis of the cylinder is along the wire. Find the couple per unit twist of the wire, If mass of cylinder is 2 kg and period of oscillation is 2s. Take π^2 as 10.
31. The young's modulus of steel is $20 \times 10^{10} \text{ Nm}^{-2}$ and density 7700 kgm^{-3} . Compute the speed of longitudinal wave in steel.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. Each question carries 15 marks:

32. What is flywheel? Explain about it with a neat diagram. With proper theory explain the experiment to find moment of inertia of flywheel.
33. What you mean by twisting couple and torsional rigidity. Obtain an expression to find torsional rigidity of a uniform solid cylinder. Also find the torsional rigidity of hollow cylinder having inner radius r_1 and outer radius r_2 .
34. With necessary theory explain about Jaegar's method for determination surface tension. How it can be used to determine surface tension at different temperature.
35. Obtain an expression for transverse wave in a stretched string. Explain about different modes of vibration.

(2 × 15 = 30 Marks)

Reg. No. :

Name :

First Semester B.Sc. Degree Examination, August 2021

First Degree Programme under CBCSS

Mathematics

Core Course

MM 1141 : METHODS OF MATHEMATICS

(2020 Admission Regular)

Time : 3 Hours

Max. Marks : 80

PART – A

Answer **all** questions. Each question carry **1** mark.

1. Write the derivative of $x^2 \sin x$.
2. Find $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x - 2}$.
3. State Extreme value theorem.
4. Find $\lim_{x \rightarrow -1} (x^2 - x)$.
5. State mean value theorem.
6. Write the equation of length of the smooth curve $y = f(x)$.
7. State theorem of Pappus.
8. Define $\cosh x$.
9. Approximate value of acceleration due to gravity is _____.
10. Write the formula for finding volume by cylindrical shell about y -axis.

(10 × 1 = 10 Marks)

P.T.O.

PART – B

Answer any **eight** questions. Each question carries **2** marks.

11. If $B = x^2$ and $\frac{dB}{dt} = 3$, find $\frac{dx}{dt}$ at $x = 10$.
12. Find the formula for dy and Δy of $y = x^3$.
13. Define a decreasing function with an example.
14. State second derivative test.
15. Express the derivative with respect to x of $y = x^2$ in differential form.
16. State L-Hospitals Rule for $\frac{\infty}{\infty}$ form.
17. If $S(t) = t^3 - 6t^2$ is the position function, find the acceleration function.
18. State Constant Difference Theorem.
19. Find the average value of the function $f(x) = 3x$ on $[1, 3]$.
20. Evaluate $\int_0^1 \frac{dx}{\sqrt{1-x}}$.
21. State Cavalieri's Principle.
22. Find the value of $\sinh 0$ and $\cosh 0$.
23. Prove that $\cosh^2 x - \sinh^2 x = 1$.
24. For what values of p does the integral $\int_1^{\infty} \frac{dx}{x^p}$ converges?
25. Define solid of revolution and axis of revolution.
26. Write the formula for finding surface area for revolution around Y -axis.

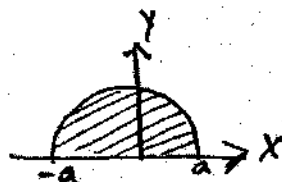
(8 × 2 = 16 Marks)

PART – C

Answer any **six** questions. Each question carry **4** marks.

27. Find the local approximation of $f(x) = \sin x$ at $x_0 = 0$ and approximate $\sin 2^\circ$ using this.
28. Find the value of (a) $\lim_{x \rightarrow 0^+} x \log x$ (b) $\lim_{x \rightarrow \pi/4} (1 - \tan x) \sec 2x$.

29. Find the relative extrema of $f(x) = 3x^5 - 5x^3$.
30. Verify Rolle's theorem for $f(x) = x^2 - 8x + 15$ on the interval $[3, 5]$.
31. Use an approximate local linear approximate to estimate the value of $\sqrt{24}$.
32. Find the dimension of the rectangle with maximum area that can be inscribed in a circle of radius 10 cm.
33. A particle moves along an s -axis. Find the position function of the particle with
- (a) $v(t) = 3t^2 - 2t$, $s(0) = 1$
- (b) $a(t) = 3 \sin 3t$, $v(0) = 3$, $s(0) = 3$.
34. Evaluate (a) $\int_1^{\infty} \frac{dx}{x^3}$ (b) $\int_1^{\infty} \frac{dx}{x}$.
35. Find the area of the region that is enclosed between the curves $y = x^2$ and $y = x + 6$.
36. Find the centroid of the semicircular region in the given figure.



37. Find the length of the graph of $f(x) = \frac{x^3}{12} + \frac{1}{x}$, $1 \leq x \leq 4$.
38. Find the volume of the region between the curves $y = x$ and $y = x^2$ in first quadrant, revolved about x -axis.

(6 × 4 = 24 Marks)

PART – D

Answer any **two** questions. Each question carry **15** marks.

39. (a) Suppose x and y are functions of t and let $x^2 + y^2 = 2x + 4y$. Given that $\frac{dx}{dt} = -5$. Find dy/dt when $(x, y) = (3, 1)$
- (b) Let $y = \sqrt{x}$. Find formulae for Δy and dy .
- (c) Find $\lim_{x \rightarrow 0} (1 + \sin x)^{1/x}$.
40. (a) Find the absolute maximum and minimum values of the functions $f(x) = 2x^3 - 15x^2 + 36x$ on the interval $[1, 5]$ and determine where the values occur.
- (b) Sketch the graph of $y = \frac{x^2 - 1}{x^3}$, and identify the locations of all asymptotes, intercepts, relative extrema and inflection points.
41. (a) Find the radius and height of the right circular cylinder of the largest volume that can be inscribed in a right circular cone with radius 6 cm and height 10 cm.
- (b) Verify mean value theorem for $f(x) = x^3 + x - 4$ on the interval $[-1, 2]$ and find the point c .
42. (a) A region is bounded by the lines $y = x^2$, $x = 2$ and x -axis. Find the volume of the solid generated by revolving the region about (i) X axis (ii) Y axis.
- (b) Find the area of surface generated by revolving the curve $y = 2\sqrt{x}$, $1 \leq x \leq 2$ about X -axis.
43. (a) The region enclosed by the X -axis and the parabola $y = 3x - x^2$ is revolved about the vertical line $x = -1$ to generate a solid. Find its volume.
- (b) Find the area of the region enclosed by $x = y^2$ and $y = x - 2$.
44. (a) Find the centre of gravity of the triangular lamina with vertices $(0, 0)$, $(0, 1)$ and $(1, 0)$ with density $\delta = 3$.
- (b) Show that if a body released from rest is in free fall, then its average velocity over a time interval $[0, T]$ during its fall is its velocity at time $\frac{T}{2}$.

(2 × 15 = 30 Marks)

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L – 3551

Reg. No. :

Name :

First Semester B.Sc. Degree Examination, August 2021

First Degree Programme Under CBCSS

Statistics

Complementary Course for Mathematics

ST 1131.1 : DESCRIPTIVE STATISTICS

(2020 Admission Regular)

Time : 3 Hours

Max. Marks : 80

Instructions: (Statistical table and Calculator are Permitted)

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. Define secondary data.
2. Give an example of non-probability sampling technique.
3. Define census method.
4. Write any two demerits of AM.
5. What you mean by skewness of a distribution?

P.T.O.

6. Define the mode of the set of observations.

15 16 18 19 16 15 16 21 16 28 9.

7. Define positive correlation.

8. What is the range of Karl-Pearson's correlation coefficient?

9. What are normal equations?

10. Who introduced the concept of regression?

(10 × 1 = 10 Marks)

SECTION – B

Answer **any eight** questions. Each question carries **2** marks.

11. The class marks in a frequency table are given to be 5, 10, 15, 20, 25, 30, 35, 40, 45 and 50. Write down the classes. What are the considerations one has to bear in mind while forming a frequency distribution.

12. Explain any one method for collecting a primary data.

13. Distinguish between probability sampling and non probability sampling.

14. What is SRSWOR?

15. What is sampling frame?

16. Mention any two measures of kurtosis.

17. Obtain the mean of first n natural numbers.

18. What is Sheppard's correction for moments.
19. Give a situation where median is the most suitable average.
20. State some demerits of arithmetic mean.
21. Calculate the standard deviation of 7,3,2,4,9,12 and 14.
22. What are the uses of scatter diagram?
23. Write the normal equation for fitting $y = ae^{bx}$.
24. Describe Spearman's rank correlation coefficient.
25. What is meant by perfect correlation?
26. Write down the formula for both the regression equations.

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions. **Each** question carries **4** marks.

27. Draw the less than ogive and greater than ogives for the following data:

Age :	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency :	3	10	16	20	18	9	2

28. Discuss the advantages of sampling over census.
29. Distinguish between simple random sampling and systematic sampling schemes.
30. Distinguish between nominal and ordinal scale of measurements.

31. Explain the concept of skewness and kurtosis.
32. Show that correlation coefficient is the geometric mean between the regression coefficients.
33. Explain the fitting of a curve of the form $y = ax^2 + bx + c$.
34. Derive the angle between two regression lines.
35. Fit an equation of the form $y = ab^x$ to the following data.

X:	2	3	4	5	6
Y:	144	172.8	207.4	248.8	298.6

36. The two regression lines are $y = ax + b$ and $x = cy + d$ and the two variables have the same means. Then show that $d(1 - a) = b(1 - c)$.
37. Form the regression line of Y on X for the given data
- | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|
| X: | 36 | 23 | 27 | 28 | 28 | 29 | 30 | 31 | 33 | 35 |
| Y: | 29 | 18 | 20 | 22 | 27 | 21 | 29 | 27 | 29 | 28 |
38. Show that the correlation coefficient is invariant under linear transformation.

(6 × 4 = 24 Marks)

SECTION – D

Answer any two questions. Each question carries 15 mark.

39. Construct a histogram and frequency polygon for the following data.

Class interval :	5-9	10-14	15-19	20-24	25-29	30-34	35-39
Frequency :	8	15	18	30	16	12	6

Drawn an ogive and estimate the median and quartile deviation.

40. (a) Calculate

(i) quartile deviation and

(ii) mean deviation from mean, for the following data.

Marks:	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No. of students:	6	5	8	15	7	6	3

(b) Draw the frequency curve to the following data:

x :	0-20	20-40	40-60	60-80	80-100
f :	9	15	23	10	8

41. Fit a curve of the form $y = a + bx + cx^2$ to the following data:

x :	10	15	20	25	30	35	40
f :	11	13	16	20	27	34	41

42. (a) Derive the standard error in the estimate of y in regression of y on x.

(b) Show that correlation coefficient $(r) = \frac{\sigma_x^2 + \sigma_y^2 + \sigma_{x-y}^2}{2\sigma_x\sigma_y}$, where σ_x^2, σ_y^2 and σ_{x-y}^2

are the variances of x, y and x - y respectively.

43. Calculate the rank correlation coefficient for the following data on heights of fathers and Sons.

Ht of father: 65 63 67 64 68 62 70 66 68 67

Ht of son: 68 66 68 65 69 66 68 65 71 67

44. (a) Given that the two regression equations are $8x - 10y + 66 = 0$ and $40x - 18y - 214 = 0$. Obtain regression coefficients and the correlation coefficient. Find the means of x and y .

If the standard deviation of x is 4, find the standard deviation of y .

- (b) Derive the regression line of x on y .

(2 × 15 = 30 Marks)

(Pages : 3)

L – 3378

Reg. No. :

Name :

First Semester B.A./B.Sc. Degree Examination, August 2021

First Degree Programme Under CBCSS

English Language and Literature

Foundation Course – I

EN 1121 & CG 1121.3 — WRITINGS ON CONTEMPORARY ISSUES

**(Common for English Language and Literature and English and
Communicative English)**

(2019 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

- I. Answer **all** questions each in a word or a sentence.
 1. Expand PARI.
 2. What is nomophobia?
 3. What is gangster capitalism?
 4. What is the functions of IMF?
 5. Why are elderly in rural India less vulnerable?
 6. What shows little sign of going away in India according to Sen?
 7. What causes rotator cuff tear?

P.T.O.

8. When was the UN formed?
9. Who wrote *Ashoka and the Decline of the Mauryas*?
10. Who proposed the Turing test?

(10 × 1 = 10 Marks)

SECTION – B

II. Answer **any eight** in not more than **50** words.

11. What is the role of authority in the practice of secularism?
12. Why do we say that the notion of Human Rights is universal?
13. How does lack of infrastructure affect old age care in India?
14. What is corporate globalism?
15. What do studies on the street children of Delhi reveal?
16. What is Roger Penrose's argument based upon?
17. Role of social laws.
18. Describe briefly the phantom cat incident.
19. Explain why the author mentions that the internet was the bane of doctors.
20. What is the fundamental objective of the U.N.?
21. The sharp regional divide that Sen notices in India.
22. How does lack of social support affect old-age care in India?

(8 × 2 = 16 Marks)

SECTION – C

III. Answer **any six** questions in around **100** words.

23. What is the solution to drug abuse?
24. Difference between weak AI and strong AI.

25. What are the primary concerns of a secular society?
26. Discuss the importance of education in relation to independent thinking.
27. What are the stages in the development of an International understanding of Human Rights?
28. What are the advantages of women's education according to Sen?
29. How does changing family structure affect senior citizens in India?
30. How has the government responded to an increase in the aging population?
31. Discuss the author's idea of "engineered inequality" in India.
- (6 × 4 = 24 Marks)**

SECTION – D

- IV. Attempt **any two** questions in not less than **300** words.
32. Why does Sen believe that education will empower women in India?
33. How does Khyrunissa use humour in her article to substantiate her arguments against using smart phones?
34. Explain Romila Thapar's views on secularism.
35. Trace the evolution of Human Rights in the global context.
- (2 × 15 = 30 Marks)**
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L – 3354

Reg. No. :

Name :

First Semester B.A./B.Sc. Degree Examination, August 2021

First Degree Programme Under CBCSS

Language Course II

Additional Language - Hindi

HN 1111.1 – HINDI KATHA SAHITYA

(2020 Admission Regular)

Time : 3 Hours

Max. Marks : 80

- I. एक शब्द या एक वाक्य में उत्तर लिखिए -
1. आधुनिक हिन्दी कहानी का प्रारम्भ कब हुआ?
2. प्रेमचन्द का सर्वश्रेष्ठ उपन्यास का नाम क्या है?
3. 'कबाडखाना' किसकी रचना है?
4. डोमिन काकी का नाम क्या है?
5. किशोर सिंह कहाँ का ज़मीनदार था?
6. मधूलिका की बेटियों के नाम क्या हैं?
7. दुखिया की पत्नी का नाम क्या है?
8. 'कामायनी' किसकी रचना है?

P.T.O.

9. 'मोबाइल' किस विधा में लिखी रचना है?
10. 'माँ रसोई में' कहानी के लेखक कौन हैं?

(10 × 1 = 10 Marks)

II. किन्हीं आठ प्रश्नों के उत्तर करीब 50 शब्दों में लिखिए -

11. प्रेमचन्द के किन्हीं चार कहानियों के नाम लिखिए।
12. लेखक की माँ ने अमरूद का पेड़ क्यों काट दिया?
13. 'शरणागत' के यूरोपियन-दम्पति के नाम क्या-क्या हैं?
14. माँ के पैर में मोच आने पर वह क्या करती है?
15. घासीराम दुखिया की लाश का ठिकाना कैसे करता है?
16. अंत में मधूलिका नवीन से बदला कैसे लेती है?
17. 'डोमिन काकी' कहानी में कौन-सी समस्या को दर्शाया है?
18. मधूलिका के दफ्तर के दोस्तों का नाम लिखिए।
19. दक्षिणा के तौर पर दुखिया क्या-क्या देता है?
20. क्षमा शर्मा के कृतित्व का परिचय दीजिए।
21. हरीश कौन-से रस्म को तोड़ने का प्रयास करता है?
22. फरहत शादी क्यों नहीं करना चाहती?
23. बिट्टो को दादी ने दूसरी बार थप्पड़ क्यों मारा?
24. जमीन्दार के घर सब प्रकार के सुख-सुविधा के बावजूद योरोपियन दम्पति आशंकित क्यों थे?

25. 'माँ रसोई में रहती है' में चित्रित विषय क्या है?
26. घोष बाबू के माली ने फसल के बारे में माँ से क्या कहा?

(8 × 2 = 16 Marks)

III. किन्हीं छः प्रश्नों के उत्तर करीब 120 शब्दों में लिखिए।

27. नवीन की चरित्रगत विशेषताओं पर प्रकाश डालिए।
28. पंडितजी दुखिया के साथ कैसा व्यवहार करता है?
29. पुरुष प्रधान समाज में मधूलिका और फरहद के संघर्ष पर प्रकाश डालिए।
30. चित्रा मुद्गल का परिचय दीजिए।
31. "सबको सब मिलकर बनाते हैं। हम सब। बेटियाँ भी इसी तरह बन जाती है। लेकिन आज के जमाने में क्या कह सकते हैं। शायद वह कुछ अलग होती। कुछ अलग बन जाती।" सप्रसंग व्याख्या कीजिए।
32. मधूलिका का चरित्र चित्रण कीजिए।
33. ओमप्रकाश वाल्मीकि के व्यक्तित्व एवं कृतित्व पर प्रकाश डालिए।
34. लेखक को अपने घर के अमरुद के पेड़ से लगाव क्यों था?
35. 'मोनाइल' शीर्षक की सार्थकता पर प्रकाश डालिए।
36. इंदिरा की चरित्रगत विशेषता पर प्रकाश डालिए।
37. 'डेविन कार्की' कहानी का सारांश लिखिए।
38. 'माँ रसोई में रहती है' कहानी की माँ का चरित्र चित्रण कीजिए।

(6 × 4 = 24 Marks)

- IV. किन्हीं दो प्रश्नों के उत्तर करीब 250 शब्दों में लिखिए।
39. 'सलाम' कहानी में चित्रित जाति-भेदभाव का चित्रण कीजिए।
40. कहानी के तत्वों के आधार पर 'सद्गति' कहानी पर प्रकाश डालिए।
41. 'शरणागत' कहानी के मूल उद्देश्य पर प्रकाश डालिए।
42. उपन्यास कला की दृष्टि से मोबाइल उपन्यास पर चर्चा कीजिए।
43. 'मोबाइल' उपन्यास में चित्रित नारी विमर्श पर प्रकाश डालिए।
44. 'मोबाइल' उपन्यास का सारांश लिखकर उसकी विशेषताओं पर प्रकाश डालिए।

(2 × 15 = 30 Marks)

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Reg. No. :

Name :

First Semester B.Sc. Degree Examination, August 2021

First Degree Programme under CBCSS

Physics

Complementary Course for Mathematics

PY 1131.1 : MECHANICS AND PROPERTIES OF MATTER

(2020 Admission Regular)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer all questions in **one** or **two** sentences. **Each** question carries **1** mark.

1. Write the dimensional formula of moment of inertia.
2. The unit of surface tension is _____
3. When the length of the cantilever is doubled, the depression becomes _____
4. A traveling wave is represented by $y = 6 \sin(2t - 6x)$, where t is in seconds and x is in meters. Its velocity of the wave is _____
5. What is the angular momentum of a body of moment of inertia I and rotational kinetic energy E ?
6. Write any two examples of simple harmonic motion (SHM).
7. What is meant by neutral axis?
8. Define radius of gyration.
9. Write general equation of a spherical wave.
10. Why detergents are used for cleaning of clothes?

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Answer any **eight** questions, not exceeding a paragraph. Each carries **2** marks. (Not to exceed **one** paragraph)

11. Write down the expression for excess pressure inside an air bubble in liquid and inside a soap bubble.
12. What do you understand by intensity of wave and on what factors does it depend?
13. Define torsional rigidity.
14. Obtain an expression for kinetic energy of a rotating body?
15. State theorems on Moment of Inertia.
16. The motion of a particle executing Simple Harmonic Motion (SHM) is given by $x = 3 \sin \omega t + 4 \cos \omega t$. What is its amplitude and phase?
17. Write down differential equation for Torsion pendulum and express its time period.
18. A great force is required to draw apart normally two glass plates enclosing a thin water film. Why?
19. Difference between angle of twist and angle of shear.
20. How viscosity of liquid and gas varies with temperature?
21. What are the conditions for the oscillatory motion to be simple harmonic?
22. Find the minimum and maximum time periods of a compound pendulum.
23. Explain why the level of water rises while that of mercury is depressed in a capillary tube.
24. Explain Newton's law of viscous flow.
25. Define bending moment.
26. A person can distinguish between raw egg and a hard-boiled egg by spinning each on the table. Explain how?

(8 × 2 = 16 Marks)

SECTION – C

Short Essay Questions. (Not to exceed 120 words) Answer any six. Each carries 4 marks.

27. A solid sphere of mass 4kg and radius 0.05 m is suspended from a wire. Find period of oscillations, if the torque required to twist the wire is $4 \times 10^{-3} \text{ N - m/radian}$.
28. A tuning fork of frequency 512 Hz produced a plane wave in air having amplitude $0.5 \times 10^{-3} \text{ mm}$. Calculate the energy density and intensity of the wave. Velocity of sound in air 332 ms^{-1} and density of air 1.29 kgm^{-3} .
29. Calculate moment of inertia of circular disc about an axis through its centre and perpendicular to its plane?
30. A particle executes Simple harmonic motion along a straight line has its motion represented by $x = 4 \sin\left(\frac{\pi t}{3} + \frac{\pi}{6}\right)$. Find
 - (a) the amplitude
 - (b) time period
 - (c) frequency
 - (d) velocity
 - (e) acceleration, at $t = 1\text{s}$, x being in cm.
31. Find the value of capillary rise when a capillary tube of radius 1 mm dipped in water (Density = 1000 kg.m^{-3} and surface tension = 0.07 Nm^{-1}).
32. Describe how viscosities of two liquids were compared.
33. The radius of a soap bubble blown in air is increased from 1cm to 4cm. How much energy will be needed if the surface tension of soap solution is $3.5 \times 10^{-2} \text{ N/m}$.
34. A cantilever of length 60 cm is depressed by 20mm at the loaded end. What is the depression at a distance 40cm from the fixed end?
35. Two mass of 2 Kg and 4Kg are joined by a spring of force constant 133 N/m and are placed a friction less horizontal table. Find the frequency of oscillation.

36. Obtain the expression for twisting couple on a cylindrical wire.
37. Calculate the mass flow of water flowing in 10 minutes through a tube 0.1 cm in diameter, 40cm long, if there is a constant pressure head of 20cm of water. The coefficient of viscosity of water is 0.00089 S I units.
38. A thin uniform bar of length 120cm is made to oscillate about an axis through its end. Find the period of oscillations and other points about which it can oscillate with the same period.

(6 × 4 = 24 Marks)

SECTION – D

Long Essay Question. Answer any **two**. Each carries 15 marks.

39. Discuss the construction of a flywheel and describe the experimental procedure used to find its moment of inertia. Derive the expression used to calculate the moment of inertia.
40. Derive an expression for the bending of a bar supported at the two ends and loaded in the middle. Describe an experiment to determine Young's modulus by bending.
41. Describe with theory to find the surface tension of a liquid and its temperature dependence by Jaeger's method.
42. Derive the differential equation for the oscillations of two particle connected by a string. Explain the behaviour of a diatomic molecule as harmonic oscillator.
43. Give the theory of flow (Poiseuille's formula) of a liquid through a uniform capillary tube. Mention its limitation of the formula.
44. Derive the moment of inertia of the following regular shaped bodies.
 - (a) A solid cylinder about an axis perpendicular to its geometrical axis and passing through its centre of mass.
 - (b) Rectangular lamina about an axis passing through the midpoint of its plane.
 - (c) A circular disc about an axis through its centre and perpendicular to its plane.

(2 × 15 = 30 Marks)

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Reg. No. :

Name :

First Semester B.Sc. Degree Examination, August 2021

First Degree Programme Under CBCSS

Mathematics

Core Course

MM 1141 : METHODS OF MATHEMATICS

(2018 – 2019 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – I

(All the questions are compulsory. Each question carries 1 mark).

1. Suppose that x and y are differentiable functions of t and are related by the equation $y = x^3$. Find $\frac{dy}{dt}$ at time $t = 1$ if $x = 2$ and $\frac{dx}{dt} = 4$ at time $t = 1$.
2. Find the local linear approximation of $f(x) = \sqrt{x}$ at $x_0 = 1$.
3. Define relative error in measurement.
4. Give the differential formula for Product rule of differentiation.
5. Define multiple roots of a polynomial.
6. Suppose that a particle moves with velocity $v(t) = \cos \pi t$ along a coordinate line. Assuming that the particle has coordinates $s = 4$ at time $t = 0$, find its position function.

P.T.O.

7. What is the volume of a solid bounded by $x = a$ and $x = b$ having a cross sectional area, $A(x)$.
8. Give the formula for length of a $y = f(x)$ curve over $[a, b]$.
9. Give the formula for work done by a variable force F in moving an object over $[a, b]$.
10. Evaluate $\int_0^{\infty} \frac{dx}{x^3}$.

(10 × 1 = 10 Marks)

SECTION – II

(Answer any eight questions. Each question carries 2 marks)

11. Assume that oil spilled from a ruptured tanker spreads in a circular pattern whose radius increases at a constant rate of 2 ft/s. How fast is the area of the spill increasing when the radius of the spill is 60 ft?
12. Find the intervals on which $f(x) = x^2 - 4x + 3$ is increasing and the intervals on which it is decreasing.
13. Define concavity of a function.
14. State a sufficient condition for f to be concave up or concave down.
15. State the extreme value theorem for $f(x)$.
16. State Rolle's theorem for $f(x)$.
17. Find the area of the region enclosed by $x = y^2$ and $y = x - 2$, integrating with respect to y .
18. State the formula for volume by cylindrical shell about the y axis.

19. A spring exerts a force of 5 N when stretched 1 m beyond its natural length. How much work is required to stretch the spring 1.8 m beyond its natural length?
20. State the theorem of Pappus.
21. Define hyperbolic sine and cosine functions.
22. Evaluate $\int_1^2 \frac{dx}{1-x}$.

(8 × 2 = 16 Marks)

SECTION – III

(Answer any six questions. Each question carries 4 marks).

23. Evaluate $\lim_{x \rightarrow \infty} \frac{x^{\frac{4}{3}}}{\sin\left(\frac{1}{x}\right)}$.
24. Define critical points and find all critical points of $f(x) = 3x^{\frac{5}{3}} - 15x^{\frac{2}{3}}$.
25. Find the relative extrema of $f(x) = 3x^5 - 5x^3$.
26. Find the absolute maximum and minimum values of the function $f(x) = 2x^3 - 15x^2 + 36x$ on the interval $[1, 5]$ and determine where these values occur.
27. A liquid form of antibiotic manufactured by a pharmaceutical firm is sold in bulk at a price of \$200 per unit. If the total production cost (in dollars) for x units is $C(x) = 5,00,000 + 80x + 0.003x^2$ and if the production capacity of the firm is at most 30,000 units in a specified time, how many units of antibiotic must be manufactured and sold in that time to maximize the profit?
28. A coin is released from rest near the Top of a building at a point that is 1250 ft above the ground. Assuming that the free-fall model applies and $g = 32 \text{ ft/s}^2$, how long does it take for the coil to hit the ground?

29. Find the area of the region that is enclosed between the curves $y = x^2$ and $y = x + 6$.
30. Find the area of the surface that is generated by revolving the portion of the curve $y = x^3$ between $x = 0$ and $x = 1$ about the x — axis.
31. Evaluate $\int_0^{\infty} (1-x)e^{-x} dx$.

(6 × 4 = 24 Marks)

SECTION – IV

(Answer any two questions. Each question carries 15 marks).

32. (a) Find the intervals in which $f(x) = x^3 - 3x^2 + 1$ increasing, decreasing, concave up and concave down. Also find the point of inflection of f .
- (b) Find the absolute external, if any, of the function $f(x) = e^{(x^3 - 3x^2)}$ on the interval $(0, +\infty)$.
33. (a) A garden is to be laid out in a rectangular area and protected by a chicken wire fence. What is the largest possible area of the garden if only 100 running feet of chicken wire is available for the fence?
- (b) Prove the identity $\cos^{-1} x + \sin^{-1} x = \frac{\pi}{2}, -1 \leq x \leq 1$.
34. (a) Derive the formula for the circumference of a circle of radius r , using improper integrals.
- (b) Find the centroid of the semicircular region in the upper half plane with radius a .
35. (a) Evaluate the derivatives of inverse hyperbolic sine and cosine functions.
- (b) Show that $\int_0^{\infty} \frac{dx}{x^p}$ converges for $p > 1$ and diverges for $p \leq 1$.

(2 × 15 = 30 Marks)