Reg. No. : ....

Name : ....

Second Semester B.Sc. Degree Examination, September 2022

First Degree Programme under CBCSS

Statistics

Foundation Course

ST 1221 : STATISTICAL METHODS II

(2020 Admission Onwards)

Time : 3 Hours   Max. Marks : 80

Instructions: Use of calculator is permitted.

SECTION – A

(Very short answer)

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

1. What are the limits for Karl Pearson correlation coefficient?

2. What is the effect of change of origin and scale on correlation coefficient?

3. Who introduced the term regression?

4. With two attributes, what is the total number of ultimate class frequencies?

5. If the regression coefficients are –0.9 and –0.4, what is correlation coefficient?

6. In the case of perfect correlation, two regression lines are

7. What is knowledge discovery in data base?

8. Define neural network

9. What is c function in R?

10. Define data warehouse.

<div align="right">(10 × 1 = 10 Marks)</div>

SECTION – B

(Short answer)

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

11. What are regression coefficients?

12. Define Spearman's rank correlation coefficient.

13. Indicate whether the following statements are true or false:

    (a) Karl Pearson correlation coefficient measures the degree of linear relationship.

    (b) Correlation between price and demand is a positive correlation.

    (c) Regression coefficients are independent of change of origin and scale.

    (d) Uncorrelated variables are independent.

14. Write short notes on principle of least squares.

15. Define rank correlation. What is its importance?

16. With the usual notations if $r_{12} = 0.7, r_{23} = r_{13} = 0.5$, find $r_{13.2}$.

17. State the properties of multiple correlation coefficient.

18. Show that two independent variables are uncorrelated.

19. Define correlation ratio. What is its use?

20. How to compute median using R?

21. What are decision trees in data mining?

22. What is the importance of logistic regression in data mining techniques?

23. Define predictive data mining.

24. How to create data frame in R?

25. How to draw a pie diagram in R?

26. Mention the usage of time series in data mining.

(8 × 2 = 16 Marks)

SECTION – C

(Short Essay questions)

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

27. Explain scatter diagram method of studying correlation.

28. Find mean values of X and Y and correlation coefficient between them from the following regression equations:
$$2Y - X - 50 = 0$$
$$3Y - 2X - 10 = 0$$

29. Define attributes. What do you mean by independence of attributes? Give a criterion of independence for attributes A and B.

30. Explain the method of fitting of an exponential curve $y = ab^x$ by principle of least squares.

31. Find the angle between two lines of regression in a bivariate distribution.

32. Distinguish between positive and negative correlations with examples.

33. Define standard error and probable error of correlation coefficient. Point out the uses of probable error of correlation coefficient.

34. Explain the procedure for obtaining quartiles and percentiles using R software.

35. Describe briefly the applications of data mining techniques.

36. Write down the R commands to plot the scatter diagram and to compute Karl Pearson coefficient of correlation for a given bivariate data.

37. Explain briefly the key features of online analytical processing.

38. Explain why excel is used for statistical purposes.

(6 × 4 = 24 Marks)

SECTION – D

(Essay questions)

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

39. (a) Define Karl Pearson coefficient of correlation, Give its interpretations.

    (b) Calculate coefficient of correlation between X and Y series from the following data and calculate its probable error. **(5 + 10 = 15)**

X	78	89	96	69	59	79	68	61
Y	125	137	156	112	107	136	123	108

40. (a) Explain the concept of regression. Write down the equations of regression lines in a bivariate distribution. What are its uses? Why there are two lines of regression? When do the two-lines coincide?

(b) The ranking of ten students in Mathematics and Statistics are as follows:

Mathematics 6 5 3 10 2 4 9 7 8 1

Statistics   3 8 4 9 1 6 10 7 5 2

Calculate Spearman's rank correlation coefficient.   **(8 + 7 = 15)**

41. (a) Describe the method of fitting a straight line $y = a + bx$ by the principle of least squares.

(b) Explain partial and multiple correlations with examples. Write down the formula for multiple correlations in terms of total and partial correlations. With the usual notations if $r_{12} = 0.77$, $r_{23} = 0.52$ and $r_{13} = 0.72$, find $R_{1.23}$.

(6 + 9 = 15)

42. (a) Define data mining and OLAP. Explain the role of data mining in data ware housing.

(b) What is clustering? What are the different clustering techniques?

(c) Explain link analysis in data mining techniques.   **(7 + 4 + 4 = 15)**

43. Explain the importance of R software in data analysis. Describe the computations of various measures of dispersion, skewness and kurtosis using R software.

(3 + 12 = 15)

44. Write short notes on the following: (5 × 3 = 15)

   (a) Classification in data mining

   (b) Nearest neighbor technique

   (c) Yule's coefficient of association

   (d) Computation of variance in excel

   (e) Assignment operators in R

                                                         (2 × 15 = 30 Marks)

   ———————

Reg. No. : ....

Name : ....

Second Semester B.Sc. Degree Examination, September 2022

First Degree Programme under CBCSS

Physics

Complementary Course for Statistics

PY 1231.3 — THERMAL PHYSICS AND STATISTICAL MECHANICS

(2020 Admission Onwards)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer all questions in a sentence or two, each carries 1 mark.

1. What is a blackbody?

2. Define Weidman-Franz law.

3. Define Wein's displacement law.

4. Define the second law of thermodynamics.

5. What is a heat engine?

6. Define efficiency of a heat engine.

7. Define entropy.

8. Define Fermi energy.

9. What are fermions?

10. A coin is tossed ten times. What is the probability of getting at least one tail?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions in a sentence or **two**, each carries **2** marks.

11. Explain thermal conductivity.

12. What is ultraviolet catastrophe?

13. Explain any two applications of Wien's displacement law.

14. Explain an isothermal process.

15. A blackbody always appears as Black. Explain whether this statement is correct or not.

16. Explain the equation for the efficiency of a Carnot's engine.

17. What are the components of a heat engine?

18. Entropy of the universe always increases, why?

19. What are the advantages of a Carnot's engine when compared to that of an ordinary heat engine?

20. State second law of thermodynamics in terms of entropy.

21. What is the role of latent heat when ice is melted to water at 0°C.

22. What is phase-space?

23. Name and very briefly explain the three ensembles in statistical mechanics.

24. What are the differences between Fermi - Dirac and Bose - Einstein statistics?

25. Explain the Planck's distribution law of a blackbody.

26. Explain the classical theory of Specific heat of solids.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions in a sentence or **two**, each carries **4** marks

27. Given that the thermal conductivity of the material of a slab is 8.4×10^{-3} $Wm^{-1}K^{-1}$. Calculate the amount of heat flows through the slab per second when the difference in temperature between the slab is 10 K. Given that the thickness of the slab is 1 cm and its area of cross section is $10^{-2}m^2$

28. The surface temperature of the Sun is 5500K. Calculate the maximum wavelength which can be emitted from the Sun. Given that Wein's constant is 0.292×10^{-2} metre K .

29. Calculate the energy radiated by a blackbody at 400K. Given that the Stefan's constant is 5.67×10^{-8} W/m^2K^4 .

30. Prove that the work done in an adiabatic change is equal to its change in internal energy.

31. Calculate the efficiency of a Carnot's engine works between 600K and 400K.

32. Calculate the entropy change when 2kg of ice at 273 K is converted to water at the same temperature. Given that the latent heat of ice is $3.35 \times 10^5 J$ kg^{-1}.

33. Draw and explain the T-S diagram of a Carnot's cycle.

34. Prove that the change in entropy in a reversible process is zero.

35. Calculate the energy of a radiation of wavelength 600nm using Planck's distribution law. Given that $h=6.62 \times 10^{-34}Js$, $C=3 \times 10^8 m/s$.

36. Derive the Rayleigh-Jeans formula for a blackbody.

37. Distinguish canonical, micro canonical and grand canonical ensembles.

38. Calculate the velocity of a free electron at a temperature of 273K. Given that the Boltzmann constant is 1.38×10^{-23} K^{-1}. Mass of the electron is 9.1×10^{-31} kg.

(6 x 4 = 24 Marks)

SECTION – D

Answer any **two** questions, each carries **15** marks.

39. Explain the method of determination of Heat conductivity of a material by Lees' disc.

40. Using the Result of Wien's displacement law and Planck's theory explain the spectrum of a blackbody.

41. Derive the equation for work done in an isothermal process.

42. Explain the working of a Carnot's engine in detail and derive the expression for its efficiency.

43. Write notes on the salient features of Maxwell-Boltzmann, Fermi Dirac and B.E. Distribution laws.

44. Explain the concepts of Free electron theory. Explain the electron energy distribution of free electrons in a metal.

(2 × 15 = 30 Marks)

—————————————

Reg. No. : ....

Name : ....

Second Semester B.A./B.Sc./B.Com. Degree Examination, September 2022

First Degree Programme under CBCSS

Language Course-English

EN 1212.1/EN 1211.2/EN 1211.3 : ENGLISH GRAMMAR USAGE AND WRITING

(Common for B.A./B.Sc./B.Com. & Career Related 2(a) Courses)

(2020 Admission onwards)

Time : 3 Hours   Max. Marks : 80

I.   Answer all questions, each in a word or a sentence.

1.   The earth revolves round the sun. (Identify the predicate)

2.   I am not so great as him. (change into Affirmative)

3.   As soon as the bell rang the children ran out of the classroom. (Begin with "no sooner")

4.   He had a ———————— escape. (use suitable form of the word 'miracle')

5.   Who would not like to win a prize? (change into assertive)

6.   How he managed to escape is not clear. (Begin with "It")

7.   The ——————— portion of the book is rather difficult. (later/latter)

8.   The man approached the door stealthily. (Identify the adverb)

9. Novel you gave me yesterday is masterpiece of author. (Insert articles wherever necessary)

10. A hundred centimetres ———— equal to a metre. (are/is).

(10 × 1 = 10 Marks)

II. Answer **any eight,** each in a short paragraph not exceeding **50** words.

11. Convert the following into a complex sentence :

    (a) We did not stir out of the house because it was raining heavily.

    (b) The fire had devastated the building, yet the people managed to escape.

12. Convert the following into a simple sentence :

    (a) You must take exercise or you will not keep healthy.

    (b) If one is kind alone, it will not help one in his career.

13. Change the voice:

    (a) He is being deceived by his own friends.

    (b) The boys are conducting a debate in the college auditorium.

14. Fill in with conjunctions:

    (a) He lost his balance ———— fell off his bicycle.

    (b) Rocky is slow ———— sure.

15. Add appropriate question tag:

    (a) You like it, ————

    (b) She is not hardworking, ————

2   P — 1031

16. Change into comparative degree :

    (a) The tiger is the most ferocious animal.

    (b) Mumbai is the seaport nearest to Europe.

17. Give the basic pattern of the following sentences :

    (a) I showed the conductor our tickets.

    (b) Mary plays the violin beautifully.

18. Rearrange the jumbled words to form meaningful sentences :

    (a) favour / this / to / you / for / am / obliged / I

    (b) accused / he / been / of / has / theft.

19. Rewrite the sentences using the adverbs provided :

    (a) She pronounced the word correctly. (quite)

    (b) Diya spoke in front of the audience. (boldly)

20. Punctuate

    (a) ma am could you help me he asked

    (b) the ganga the yamuna and the narmada are three of the longest Indian rivers

21. Complete using a clause :

    (a) All believed —————— (noun clause)

    (b) I saw a man —————— (adjectival clause)

22. Add an appropriate interrogative pronoun :

    (a) —————— would you like to go for a picnic?

    (b) To —————— shall I send this letter?

23. Frame questions to get the underlined words as answers :

    (a) The book is dedicated to <u>his father</u>.

    (b) The government has launched <u>a new road safety campaign</u>.

24. Convert the sentences into plural form :

    (a) The ox has a cloven hoof

    (b) A thief stole the box of a traveller.

25. Identify the principal and subordinate clauses in the sentences:

    (a) She left the office when her work was over.

    (b) It is clear that it is going to rain today.

26. Fill in using since or for:

    (a) Life has changed completely ———————— I left college.

    (b) He has been ill ———————— a month now.

(8 × 2 = 16 Marks)

III. Answer **any six** of the following as directed :

27. Fill in the blanks with suitable prepositions.

    (a) He fought ———————— courage.

    (b) He is indebted ———————— his friend.

    (c) The mountains were covered ———————— snow.

    (d) The father has faith ———————— his son.

    (e) Do not speak ill of a person ———————— his back.

(f)   I left school ——————— the age of sixteen.

(g)   Jake was standing ——————— the counter.

(h)   Please pay me ——————— cash.

28.   Complete the sentences using the correct form of the tenses:

The water level ——————— (rise) fast. It ——————— (continue) to rise and ——————— (reach) the danger mark already. The authorities ——————— (look) into the matter.

29.   Complete using suitable modals.

(a)   I ——————— speak Bengali fluently.

(b)   Her father ——————— permit her to join the course.

(c)   What ——————— you like for dinner?

(d)   She ——————— have worked harder for her examinations.

30.   Join the sentences using a connective:

(a)   We got into a bus. It was crowded.

(b)   The dog bit the burglar. The burglar had broken into the house.

(c)   He cannot afford a motor-car. He is too poor.

(d)   The storm ceased. The sun came out.

31.   Change the italicized word as directed:

(a)   Satyajit Ray is a film director of *repute*. (into adjective)

(b)   The soldiers fought the battle *courageously*. (into noun)

(c)   He treated us with *kindness*. (into adverb)

(d)   Smoking is *injurious* to health.(into verb)

32. Correct the sentences:

(a) They can't hardly speak English.

(b) The pineapple is less sweet than the mango.

(c) Whatever happen I will face it.

(d) When I was in Kerala, he came to see me each day.

33. Complete using articles:

——————— effective way of opening ————— essay is with ———————
question. ————— reader's attention is at once gripped by —————
striking questions. Therefore, ————— good essay should never miss
——————— question in ————— beginning.

34. Rewrite as instructed:

(a) It is your duty to look after your parents. (rewrite using the modal "ought to")

(b) I saw a ————— of ships in the harbor. (use a collective noun)

(c) The <u>waiter</u> served us food. (change the gender of the underlined word)

(d) Give me some food <u>which I can eat.</u> (replace the adjectival clause with "to")

35. Identify the difference in meaning of the sentences :

(a) He said he had worked in Chennai.

He said he would be working in Chennai.

(b) Someone phoned you.

Someone has been phoning you.

36. Change the narration (into direct or indirect):

   (a) "Sit down boys," said the teacher.

   (b) My father asked me if I had to leave the following week.

   (c) He said to me, "Can I use your computer?"

   (d) The sailor said, "My captain is a cruel fellow".

37. Construct a dialogue between Ravi and the clerk at a post office regarding the sending of a document by speed post.

38. Draft a questionnaire to be circulated among the students of a college to assess the impact of online shopping.

(6 × 4 = 24 Marks)

IV. Answer **any two** of the following.

39. Write a short essay on Social Media-A Necessary Evil.

40. You are the Sports Secretary of ABX College. Write a report on the inauguration of the new indoor gymnasium in the college.

41. Construct a story from the given outline :

   An old lady loses her eye sight-calls a doctor-promises high fees if cured- doctor calls daily-covets pieces of her furniture daily-finally cures her-asks for fees-she refuses-doctor files a case-she says her sight not properly restored-cannot see her furniture-judge gives verdict in her favour.

42. Expand the proverb: A stitch in time saves nine.

43. Prepare a newspaper report on the damage caused by the indiscriminate use of plastic in your city.

44. Write a dialogue between two friends about a movie released in OTT platform.

(2 × 15 = 30 Marks)

Reg. No. : ....

Name : ....

Second Semester B.A./ B.Sc. Degree Examination, September 2022

First Degree Programme under CBCSS

Language Course – III - English

EN 1211.1 : Ability Enhancement Compulsory Course:

ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

(2020 Admission Onwards)

Time : 3 Hours   Max. Marks : 80

I: Answer all questions, each in a sentence or two.

1.   What do you understand by energy conservation?

2.   Who is Chief Seattle?

3.   What is meant by Flagship species?

4.   Where is 'A Fable for Tomorrow' set?

5.   What does the narrator's wife do to the centipede?

6.   What is cumulative impact?

7.   What is WWF?

8.   Who is the speaker of Satchidanandan's poem?

9.   What is Basel Convention?

10. Who is in charge of a relief camp?

(10 × 1 = 10 Marks)

II. Answer **any eight**, each in a paragraph not exceeding **50** words.

11. Which are the four subsystems / spheres of the earth?

12. What is the opinion of Chief Seattle about the white man's cities?

13. Explain the central theme explored in Tagore's essay.

14. What are terrestrial and aquatic ecosystems?

15. What do you understand by the term 'Trophic Cascade'?

16. Which are the factors for biodiversity depletion according to Edward Wilson?

17. Comment on the narrator's encounter with the cobra.

18. Mention a few sustainable forestry practices.

19. What is deforestation?

20. How does Gieve Patel explain the growth of a tree?

21. What are the single-use plastic products?

22. How does plastic affect the marine life?

23. What is Chernobyl disaster?

24. "Rise up, brave peasants, reading/future's gold in paddy fields". Comment.

25. Who is Tasha?

26. How does WHO define a natural disaster?

(8 × 2 = 16 Marks)

III. Answer any **six** in a paragraph not exceeding **100** words.

27. "The earth does not belong to man-man belongs to earth". Comment.

28. How does Kalidasa bring out the relationship between man and nature in his works?

29. "Then a strange blight crept over the area and everything began to change". Discuss.

30. What are the narrator's contemplations on killing rats?

31. Which are the major kinds of pollution? Explain.

32. Why is it important for the poet to remember Hiroshima?

33. What is e-Waste? What are the challenges and threats posed by e-waste?

34. What is SCMG? What are its functions?

35. Explain the various methods adopted to mitigate the adverse effects of floods.

36. Comment on the irony in the lines "till I told them I wasn't a government official".

37. "It felt like somebody had filled our bodies up with red chillies". Comment.

38. What were the two emergency situations faced by Arif?

(6 x 4 = 24 Marks)

IV. Answer any **two** of the following in not less than **300** words.

39. Elucidate the contrasting attitudes of the Red man and the white man towards Nature as explained in Chief Seattle's speech.

40. Camille T. Dungy's poem discusses a major ecological concern. Substantiate.

41. Attempt a critical appreciation of Basheer's story.

42. Nissim Ezekiel's poem presents the apathy and indifference of the bureaucracy towards the victims of natural disasters. Examine.

43. "People simply started dying in the most hideous ways". Comment on the immeasurable devastation caused by the Bhopal gas tragedy.

44. "Briefly explain the measures taken in the setting up of a relief camp and the rehabilitation of the victims of disasters.

(2 × 15 = 30 Marks)

Reg. No. : ....

Name : ....

Second Semester B.A./B.Sc. Degree Examination, September 2022

First Degree Programme Under CBCSS

Language Course – Additional Language – Hindi

HN 1211.1 — HINDI NIBANDH AUR ANYA GADYA VIDHAYEM

(2020 Admission Ownwards)

Time : 3 Hours　　　　　　　　　　　　　　　　　　Max. Marks : 80

I.　एक शब्द या वाक्य में उत्तर लिखिए।

1.　'आधुनिक हिन्दी का जन्मदाता' कौन है?

2.　'कुटज' का रचनाकार कौन है?

3.　'कलम का सिपाही' किस विधा की रचना है?

4.　परसाईजी के अनुसार निन्दा का उद्‌गम कहाँ से होता है?

5.　'सफेद मेमने' किसकी रचना है?

6.　'सूखे सरोवर का भूगोल' किस विधा की रचना है?

7.　'तिरछी रेखाएँ' का रचयिता कौन है?

8.　'माटी के मूरतें' किसकी रचना है?

9.　सूरदास ने निंदा को किस नाम से संबोधोत किया?

10.　'मेरा हमदम मेरा दोस्त' किस विधा की रचना है?

(10 × 1 = 10 Marks)

P.T.O.

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

11. कमलेश्वर के व्यक्तित्व के बारे में राजेन्द्र यादव का विचार व्यक्त कीजिए।

12. राजेन्द्र यादव का, कमलेश्वर से व्यक्तिगत परिचय कब हुआ था?

13. बडौदा राज्य में नौकरी करना अंबेडकर के लिए क्यों आवश्यक हो गया था?

14. पारसी सराय में अंबेडकर का रहन-सहन किस प्रकार का था?

15. हज़ारी प्रसाद द्विवेदीजी के अनुसार कालिदास ने हिमालय और देवदारु की चर्चा किस प्रकार की है?

16. देवदारु वनस्पति की मर्यादा से वंचित क्यों रहा?

17. मुंशी प्रेमचंद ने कन्यादान क्यों नहीं किया?

18. प्रेमचन्द के समय में लडकी को पढ़ाना अपने आप में एक क्रान्ति क्यों थी?

19. तांडव किस प्रकार का नाच है?

20. धर्मान्तरण संबन्धी डॉ. अंबेडकर की मान्यताओं पर विचार कीजिए।

21. हज़ारी प्रसाद द्विवेदीजी की रचनाओं का परिचय दीजिए।

22. एक साहित्यकार के रूप में अमृतराय का महत्व समझाइए।

23. मणिमधुकर का परिचय दीजिए।

24. धिराणी माँ किस प्रकार की नारी थी?

25. भारत के अछूतों की स्थिति को डॉ. अंबेडकर ने किस प्रकार चित्रित किया है?

26. गेहूँ और संगीत का आपसी संबन्ध किस प्रकार बना?

(8 × 2 = 16 Marks)

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

27. 'पता नहीं, किसने इस पेड का नाम देवदारु रख दिया था, नाम निश्चय ही पुराना है, कालिदास से भी पुराना, महाभारत से भी पुराना'। कथन की विवेचना कीजिए।

28. 'मगर देवदारु नाम केवल नाम ही नहीं है! मैं ने अपने गाँव के एक महान भूत-भगवान ओझा को देवदारु की लकडी से भूत भगाते देखा है'। भाव समझाइए।

29. 'घर में उस समय और कोई न था। इसलिए मुंशीजी खुद ही गये और पास के एक हलवाई के यहाँ से मिठाई ले आये' प्रसंग लिखिए।

30. 'शादी-ब्याह एक दिन का रिस्ता नहीं हमारा उनका यह तीन पुश्तों का रिस्ता होगा। इसलिए आप उनको दिवालिया न कीजिएगा'। कथन की विवेचना कीजिए।

31. व्यंग्य के स्वरूप को समझाइए।

32. 'गेहूँ हम खाते हैं, गुलाब सूँघते हैं। एक से शरीर की पुष्टि होती हो, दूसरे से मानस तृप्त होता है'। – आशय समझाइए।

33. 'अभिमन्यु की आत्महत्या' नामक कहानी की पहली चिनगारी राजेन्द्र यादवजी को कैसे मिली?

34. 'हर झूठा और पढ़ा-लिखा आदमी कहानीकार नहीं हो सकता वरना आज सारे के सारे प्रयागवासी कवि आलोचक, कहानीकार हो गए होते।' – आशय समझाइए।

35. 'गेहूँ बनाम गुलाब' शीर्षक की प्रतीकात्मकता पर विचार कीजिए।

36. ललित निबन्ध के स्वरूप का परिचय दीजिए।

37. गद्य के विविध रूपों का परिचय दीजिए।

38. 'क' से क्या मैं गले मिला? क्या मुझे उसने समेटकर कलेजे से लगा लिया? हरगिज़ नहीं'। आशय समझाइए।

(6 × 4 = 24 Marks)

IV. किन्हीं दो प्रश्नों के उत्तर ढाई सौ शब्दों में लिखिए।

39. 'देवदारु' की विशेषताओं को समझाइए।

40. 'बेटी का विवाह' जीवनी पर विचार कीजिए।

41. 'बड़ौदा का अनुभव' पर प्रकाश डालिए।

42. 'निन्दारस' में अभिव्यक्त व्यंग्य का परिचय दीजिए।

43. 'सूखे सरोवर का भूगोल' रिपोर्ताज का परिचय दीजिए।

44. 'गेहूँ बनाम गुलाब' का सारांश लिखिए।

(2 × 15 = 30 Marks)

Reg. No. : ....

Name : ....

Second Semester B.Sc. Degree Examination, September 2022

First Degree Programme under CBCSS

Mathematics

Complementary Course for Statistics

MM 1231.4 : MATHEMATICS II – INTEGRAL CALCULUS AND SEQUENCES AND SERIES

(2021 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions :

1. Evaluate $\int_{-e}^{-1} \frac{1}{x} dx$.

2. Find $\int \cos^4 x \, dx$

3. Write the formula for integration by parts.

4. Find the parametric equations for the surface generated by revolving the curve $y = \frac{1}{x}$ about the x-axis.

5. What is a spiral?

6. Write the conversion formulas for spherical coordinate system to rectangular coordinate system.

7. Find the general term of the sequence $\dfrac{1}{2}, -\dfrac{2}{3}, \dfrac{3}{4}, -\dfrac{4}{5}, \dots$

8. Write the power series for the Bessel function $J_1(x)$.

9. Give an example of a power series in $x - 1$.

10. State the convergence of p - series.

(**10 × 1 = 10 Marks**)

SECTION – B

Answer **any eight** questions.

11. Evaluate $\int \ln x \, dx$.

12. Evaluate $\displaystyle\int_0^2 x(x^2 + 1)^3 \, dx$.

13. Sketch the region whose area is represented by the definite integral $\displaystyle\int_1^2 2 \, dx$.

14. State the mean-value theorem for integrals.

15. Evaluate : $\displaystyle\int \dfrac{dx}{x^2 + a^2}$ where $a \ne 0$ is a constant.

16. Evaluate : $\displaystyle\int \dfrac{e^{\sqrt{x}}}{\sqrt{x}} \, dx$.

17. Find the area of the region enclosed by $x = y^2$ and $y = x - 2$.

18. Differentiate the Bessel function $J_0(x)$ with respect to x.

P – 1314

19. Find the partial derivatives of $r = u\,\mathbf{i} + v\,\mathbf{j} + (4 - u^2 - v^2)\mathbf{k}$.

20. Define a cardioid.

21. Find the rectangular coordinates of the point whose polar coordinates are $\left(6, \dfrac{2\pi}{3}\right)$.

22. Determine whether the series $\displaystyle\sum_{k=0}^{\infty} \dfrac{5}{4^k}$ converges. If so, find its sum.

23. Find all values of x for which the series $\displaystyle\sum_{k=0}^{\infty} x^k$ converges. Also find the sum of the series for those values of x.

24. State the ratio test for absolute convergence.

25. Find the nth Taylor polynomial for $\dfrac{1}{x}$ about $x = 1$ and express it in sigma notation.

26. Prove that the series $\displaystyle\sum_{k=1}^{\infty} \dfrac{k}{k+1}$ diverges.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions.

27. Evaluate : $\displaystyle\int \dfrac{x}{x^2 - 4x + 8}\,dx$.

28. Compute the value of the integral : $\displaystyle\int x^2 e^{-x}\,dx$.

29. Find the total area between the curve $y = 1 - x^2$ and the x - axis over the interval $[0, 2]$.

30. Find the volume of the solid generated when the region between the graphs of the equations $f(x) = \dfrac{1}{2} + x^2$ and $g(x) = x$ over the interval $[0, 2]$ is revolved about the x - axis.

31. Let G be the wedge in the first octant that is cut from the cylindrical solid $y^2 + z^2 \leq 1$ by the planes $y = x$ and $x = 0$. Compute $\iiint\limits_{G} z\, dV$.

32. Find the area of the region R enclosed between the parabola $y = \dfrac{x^2}{2}$ and the line $y = 2x$.

33. Find the nth Maclaurin polynomial for e^x.

34. Verify whether the sequence : $\left\{ \dfrac{n}{2n+1} \right\}_{n=1}^{\infty}$ converges or diverges.

35. Find the volume of the solid bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$.

36. Use the ratio test for absolute convergence to determine whether the series $\sum\limits_{k=1}^{\infty} (-1)^k \dfrac{2^k}{k\,!}$.

37. Find the sum of the series $\sum\limits_{k=1}^{\infty} \left(\dfrac{3}{4^k} - \dfrac{2}{5^{k-1}} \right)$.

38. Briefly explain the geometric series.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions.

39. (a) Find the arc length of the curve $y = \dfrac{x^2}{2}$ from $x = 0$ to $x = 1$.

    (b) Find the area of the ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$.

40. Evaluate :

    (a) $\displaystyle\int \frac{3x^4 + 3x^3 - 5x^2 + x - 1}{x^2 + x - 2}\, dx$

    (b) $\displaystyle\int_0^{\frac{3}{4}} \frac{dx}{1 - x}$

    (c) $\displaystyle\int_0^{\ln 3} e^x (1 + e^x)^{\frac{1}{2}}\, dx$.

41. Sketch the graph of $r^2 = 4\cos 2\theta$ in polar coordinates.

42. (a) Derive the equation of the tangent plane to the parametric surface $x = uv$, $y = u$, $z = v^2$ at the point where $u = 2$ and $v = -1$.

    (b) Find the volume of the solid within the cylinder $x^2 + y^2 = 9$ and between the planes $z = 1$ and $x + z = 5$.

43. Examine whether the following series converge or divergence.

    (a) $\displaystyle\sum_{k=1}^{\infty} \frac{1}{\sqrt{k} + 1}$

    (b) $\displaystyle\sum_{k=1}^{\infty} \frac{1}{2k^2 + k}$

    (c) $\displaystyle\sum_{k=1}^{\infty} \frac{3k^3 - 2k^2 + 4}{k^7 - k^3 + 2}$.

44. Find the interval of convergence and radius of convergence of the following, power series :

(a) $\displaystyle\sum_{k=0}^{\infty} x^k$

(b) $\displaystyle\sum_{k=0}^{\infty} \frac{x^k}{k!}$

(c) $\displaystyle\sum_{k=0}^{\infty} k! \, x^k$

(d) $\displaystyle\sum_{k=0}^{\infty} \frac{(-1)^k x^k}{y^k (k+1)}$.

(2 × 15 = 30 Marks)

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