

Reg. No. : .....

Name : .....

**Second Semester B.Sc. Degree Examination, December 2021**

**First Degree Programme Under CBCSS**

**Statistics**

**Complementary Course for Mathematics**

**ST 1231.1 — PROBABILITY AND RANDOM VARIABLES**

**(2018 and 2019 Admission)**

Time : 3 Hours

Max. Marks : 80

**SECTION – A**

Answer **all** questions, each question carries **1** mark.

1. Define sample space of a random experiment with suitable example.
2. When will you say that several events are mutually exclusive and exhaustive?
3. Mention any two drawbacks of the classical definition of probability.
4. State multiplication theorem of probability.
5. Define a priori probability.
6. Distinguish between discrete and continuous random variables.
7. Find the value of  $a$ , if a random variable  $X$  had pdf  $f(x) = ae^{-\frac{x}{5}}$ ,  $x > 0$ .
8. For two random variables  $X$  and  $Y$ , show that  $E(X + Y) = E(X) + E(Y)$
9. Show that the first central moment of a random variable is always zero.
10. Show by an example that the moment generating function of a random variable does not exist always.

**(10 × 1 = 10 Marks)**

P.T.O.

SECTION – B

Answer any **eight** questions, each question carries **2** marks.

11. Seven balls are distributed in two bags at random. What is the probability that the first bag contains 4 balls?
12. If two unbiased dice are thrown, what is the probability that the product of the outcomes is a prime number?
13. If  $A$  and  $B$  are mutually exclusive events and  $P(A) = \frac{1}{3}$  and  $P(B) = \frac{1}{4}$ , find the values of  $P(\bar{A} \cap B)$  and  $P(\bar{A} \cup B)$ .
14. Show that if two events  $A$  and  $B$  are independent,  
$$P(A \cap B) = P(A)P(B)$$
15. Show that pairwise independence does not imply mutual independence, with the help of an example.
16. A bag contains 3 oranges and 2 apples and another bag contains 4 oranges and 3 apples. A bag is selected at random and one fruit is drawn from the selected bag. What is the probability that the selected fruit is an orange?
17. Define the distribution function of a random variable. What are its important properties?
18. The joint pdf of two random variables  $X$  and  $Y$  is

$$f(x, y) = \frac{1}{27}(x + 2y), \quad x = 0, 1, 2; \quad y = 0, 1, 2$$

Find the marginal density functions of  $X$  and  $Y$ .

19. If a random variable  $X$  has pdf  $f(x) = e^{-x}$ ,  $x > 0$ , find the distribution of  $Y = 3X$ .
20. Show that  $\mu_2 = \mu_2' - (\mu_1')^2$  where  $\mu_r$  represents  $r^{\text{th}}$  central moment and  $\mu_r'$  represents the  $r^{\text{th}}$  raw moment.
21. Define the conditional expectation  $E(X/Y)$ .
22. Define the characteristic function of a random variable. What is its advantage over the moment generating function?

(8 × 2 = 16 Marks)

SECTION – C

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

23. State and prove addition theorem of probability.
24. A five digit number is formed with digits 0,1,2,3,4. Find the probability that the number is (a) divisible by 5 (b) an odd number.
25. The probability that a 50 year old man will be alive at 60 is 0.83 and the probability that a 45 year old woman will be alive at 55 is 0.87. What is the probability that a man, who is 50 and his wife, who is 45 will both alive 10 years hence?
26. State and prove Baye's theorem.
27. Find the value of  $k$  such that  $f(x) = kx(1-x)$ ,  $0 < x < 1$  is a pdf. Also find  $P\left[X > \frac{1}{2}\right]$ .
28. The joint pdf of two random variables  $X$  and  $Y$  is given by  $f(x,y) = \frac{1}{8}(6-x-y)$ ,  
 $0 < x < 2$ ,  $2 < y < 4$
- (a) Find the marginal density functions of  $X$  and  $Y$
- (b) Examine whether  $X$  and  $Y$  are independent.
29. If  $X$  is a random variable with density function  $f(x) = \left(\frac{1}{2}\right)^x$ ,  $x = 1,2,3,\dots$ , find the pdf of  $Y = X^2$ .
30. Derive the relationship between the  $r^{\text{th}}$  central moment and raw moments.
31. When will you say that several random variables are mutually independent? Give an example for mutually independent events.

(6 × 4 = 24 Marks)

SECTION – D

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

32. (a) Define the term 'Statistical regularity'. How the probability is defined based on this property?
- (b) A town has two doctors  $A$  and  $B$ , working independently. The probability that doctor  $A$  is available for consultation at a particular time is 0.9 and the doctor  $B$  is available with probability 0.8. What is the probability that at least one doctor is available when needed?

33. (a) Define the conditional probability of events.
- (b) For three events  $A$ ,  $B$  and  $C$ . show that

$$P(A \cup B / C) = P(A / C) + P(B / C) + P(A \cap B / C)$$

34. (a) Define probability mass function of a discrete random variable. What are its important properties?
- (b) A coin is tossed till the outcome is 'head' and the random variable  $X$  denote the number of tosses. Write the probability mass function of  $X$ .
35. (a) Show that the moment generating function of the sum of two independent random variables is the product of their moment generating functions.
- (b) If a random variable  $X$  has pdf  $f(x) = \lambda e^{-\lambda x}$ ,  $x > 0$ , find the moment generating function and hence the mean and variance of  $X$ .

**(2 × 15 = 30 Marks)**

(Pages : 4)

M – 2341

Reg. No. : .....

Name : .....

**Second Semester B.Sc. Degree Examination, December 2021**

**First Degree Programme Under CBCSS**

**Physics**

**Complementary Course for Mathematics**

**PY 1231.1 — THERMAL PHYSICS AND STATISTICAL MECHANICS**

**(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. What are the desirable thermal properties of material to be used for constructing cooking utensils?
2. Give an estimate on the temperature of photosphere and core of the sun.
3. Plot the TS diagram of a Carnot's cycle.
4. How does entropy vary in reversible and irreversible processes?
5. What does the second law of thermodynamics represent?
6. Entropy is considered as an extensive property. Why?
7. Why do we call thermal radiation as infrared radiation?
8. Differentiate between isochoric and isobaric processes.
9. What is the main objective of statistical mechanics?
10. What is a pyrheliometer?

**(10 × 1 = 10 Marks)**

P.T.O.

## SECTION – B

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

11. Explain the molecular theory for heat conduction.
12. Work out the analogy between black body radiation and a perfect gas.
13. In a furnace, two iron pieces are heated to the same temperature. One piece is then taken out. Which piece will appear brighter just at this instant? Explain.
14. Draw the blackbody spectrum for three temperatures with emissive power as a function of wavelength.
15. Distinguish between closed and isolated systems with example.
16. Give the important properties of entropy.
17. How does the internal energy of a system develop?
18. List the significances and limitations of first law of thermodynamics.
19. Draw the PV diagram for a diesel engine.
20. Mention the important characteristics of heat engine cycles.
21. Make a comparison on reversible and irreversible processes.
22. Show that for the whole system on which the Carnot engine operates, the algebraic sum of the entropy changes for the whole cycle is zero.
23. Explain why adiabatic compression causes heating.
24. What is a phase space?
25. What are the assumptions made in stating Rayleigh Jean's law?
26. What is a black body? What are its characteristics?

**(8 × 2 = 16 Marks)**

## SECTION – C

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

27. Distinguish between thermometric conductivity and thermal conductivity.
28. Thermal conductivity of brass is 4 times of copper. Two bars, one of brass and the other of copper of same length and same cross sectional area are joined together. The free ends of copper and brass are kept at steam point and ice point respectively. Find the temperature of the joint in the condition of steady state. Heat loss due to radiation is neglected.

29. Calculate the work done when one litre of monatomic perfect gas at NTP is compressed adiabatically to half its volume.  $\gamma = 1.66$ .
30. Show that there is no change in entropy for reversible cycle.
31. For a Diesel engine, find the adiabatic compression ratio if the combustion expansion ratio is 4. Given the efficiency of the engine as 52.0% and  $\gamma = 1.4$ .
32. Calculate the average energy of Planck's oscillator for  $(h\omega/KT) = 0.01, 0.1, 1.0$  and  $10.0$ .
33. The solar radiation with maximum energy is found to be at 490 nm. If the Wien's constant is 0.002898, find the temperature of the sun. Also find the temperature of the moon, if the 14  $\mu\text{m}$  radiations are the most intense from the moon.
34. Compare the ensembles.
35. Prove that the adiabatic curve is steeper than the isothermal curve at a point where the two curves intersect each other.
36. The electrical conductivity of a copper wire of length 500 m and diameter 0.2 mm at room temperature is  $5.9 \times 10^7 \Omega^{-1} \text{m}^{-1}$ . Find its thermal conductivity if the Lorentz number is  $2.32 \times 10^{-8} \text{W}\Omega\text{K}^{-2}$ .
37. A wooden ice box of 1.8 cm thick, lined inside with cork 4 cm thick. If the temperature of the inner surface of the cork is  $0^\circ\text{C}$  and that of the outer surface of wood is  $10^\circ\text{C}$ , what is the temperature of the interface? The thermal conductivity of wood is  $0.12 \text{Wm}^{-1} \text{K}^{-1}$  and that of cork is  $0.037 \text{Wm}^{-1} \text{K}^{-1}$ .
38. Show that the value of  $v_x$  is  $(4.6 \text{ kT/m})^{0.5}$  for which the probability falls to 0.1 times the maximum value.

**(6 × 4 = 24 Marks)**

### SECTION – D

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

39. Discuss the Lee's disc method for finding the conductivity of bad conductors.
40. Derive the expressions for the work done during isothermal and adiabatic processes. Distinguish between adiabatic and isothermal elasticities.

41. Explain the energy distribution in black body radiation. Discuss the success and limitations of the classical theory in explaining it. Derive Planck's radiation formula and explain how it overcomes the short comings of the classical theory.
42. Briefly describe the Maxwell Boltzmann energy distribution and velocity distribution laws.
43. With necessary theory describe the working of petrol engine. Derive the expression for its efficiency.
44. Establish the relation between the second law of thermodynamics and entropy. Analyse the entropy change when ice is converted into steam.

**(2 × 15 = 30 Marks)**



(Pages : 4)

M – 2136

Reg. No. : .....

Name : .....

**Second Semester B.A./B.Sc./B.Com. Degree Examination, December 2021.**

**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. and Career Related Group 2(a))**

**(2019 Admission)**

Time : 3 Hours

Max. Marks : 80

- I. Answer **all** questions each in a word or a sentence.
  1. Change the voice in the sentence.  
Let them go.
  2. Change the sentence "I love eating ice cream" into negative.
  3. Supply the question tag for, "You are ok \_\_\_\_\_".
  4. Correct the following sentence.  
I write fictions.
  5. Begin the following sentence with it.  
To write an essay is not easy.
  6. Choose the correct verb form.  
Trouble \_\_\_\_\_ (choose/chose) to follow the politician wherever he went.
  7. Identify if the following sentence is grammatically correct or not.  
The actor grew up as an only child.

P.T.O.

8. Rewrite the sentence using the adverb provided.  
I am sad. (quite)
9. Complete the sentences with the correct option.  
They are two \_\_\_\_\_ of the same puzzle. (half/halves)
10. The majority of workers \_\_\_\_\_ not turned up for the strike. (has/have)

(10 × 1 = 10 Marks)

II. Answer **any eight** of the following questions as per instructions:

11. Convert the following into a compound sentence.
- (a) I have an interview. I am late for it.
  - (b) The menagerie is far away. It is flooded.
12. Convert the following into a simple sentence.
- (a) He is a cop. It is true.
  - (b) Gopal is alone. He is still cheerful.
13. Correct the following sentences.
- (a) Ritu shaked the pencil.
  - (b) He gave to me a pen holder.
14. Change the voice.
- (a) We must take care of the puppy.
  - (b) Close the gate.
15. Fill in the blanks using the correct verb given in brackets.
- (a) The boy has been \_\_\_\_\_ (missing/to miss) since last week.
  - (b) Unicorns \_\_\_\_\_ only in fairy tales. (exist/existed).
16. Choose the correct usage.
- (a) Half the shelf \_\_\_\_\_ (is/are) filled with organic products.
  - (b) Everyone \_\_\_\_\_ (has/have) duties.
17. Change into comparative degree:
- (a) His bike is as old as mine.
  - (b) Megha is the brightest student in the class.

18. Frame a question to get the underlined word as answer.
- (a) He is a critically acclaimed novelist.
  - (b) I am living in Melbourne since last year.
19. Add the correct question tag.
- (a) Everyone came to the movie premiere, \_\_\_\_\_ ?
  - (b) Buying a new house is a risky affair, \_\_\_\_\_ ?
20. Reorder the jumbled sentences.
- (a) Struggling dancer/ been/ I/ have/a
  - (b) Went/ hiking trip/ they/ on a
21. Choose the appropriate option to fill in the blanks.
- (a) The principal did not intend to discuss it any (further/ farther)
  - (b) Ravi had done it with the \_\_\_\_\_ intentions in mind (best/better).
22. Rewrite into positive sentences.
- (a) I hate cooking.
  - (b) He does not like giving impromptu speeches.

(8 × 2 = 16 Marks)

III. Answer **any six**, as directed:

23. Write a conversation between two friends on a matter of importance.
24. Expand the following proverb:  
A stitch in time saves nine.
25. Prepare a questionnaire to assess the pattern of spending time online among teenagers.
26. Prepare a conversation between a teacher and a student who failed a test paper.
27. Change the following conversation into Reported Speech:
- Zain: What are you doing?  
Cathy: Trying to prepare a quick lunch.  
Zain: Do you need my help?  
Cathy: Sure. Prep these ingredients for me!

28. Change the following into passive voice.
- (a) You can listen to the new song now.
  - (b) I saw a Banksy painting for sale at the auction.
  - (c) Somebody stole my purse.
  - (d) He gave the correct directions.
29. Fill up using articles:
- She has bought \_\_\_\_\_ new watch for you \_\_\_\_\_ watch is very expensive. It is \_\_\_\_\_ smart watch with \_\_\_\_\_ latest features and \_\_\_\_\_ platinum strap.
30. Correct the following sentences.
- (a) Good friends is harder to come by these days.
  - (b) I and you can clean this mess.
  - (c) She is here since seven days.
  - (d) He gave the speech herself.
31. Complete using suitable modals.
- (a) I \_\_\_\_\_ leave now, as I have to finish my homework. (should/would)
  - (b) It \_\_\_\_\_ rain tomorrow. (may/have)
  - (c) You \_\_\_\_\_ deliver the talk now. (must/should)
  - (d) She \_\_\_\_\_ dance properly. (can/would)

(6 × 4 = 24 Marks)

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

- 32. Expand the proverb "A thing of beauty is a joy forever".
- 33. Write a report on the PTA meeting that took place in your college.
- 34. Write a short essay on the importance of health care workers during the pandemic.
- 35. Write a report on the importance of world peace.

(2 × 15 = 30 Marks)

(Pages : 3)

M – 2134

Reg. No. : .....

Name : .....

**Second Semester B.A./B.Sc. Degree Examination, December 2021**

**First Degree Programme Under CBCSS**

**Language Course**

**EN 1211.1 : ABILITY ENHANCEMENT COMPULSORY COURSE:  
ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT**

**(2020 Admission Regular)**

Time : 3 Hours

Max. Marks : 80

- I. Answer **all** questions, each in a sentence or two. Each question carries **1** mark.
1. What is biodiversity?
  2. Why is the air precious to the red man?
  3. Define Ecosystem.
  4. Which are the two birds who have returned due to trophic cascade?
  5. What is identified as a major threat to the conservation of the natural resources and the biodiversity?
  6. What is a biodiversity hotspot?
  7. What do you mean by environmental pollution?
  8. Who is the speaker of the poem "The memory of Hiroshima"?
  9. Expand UNISDR.
  10. Give the name of the gas leaked out of the UCC plant at Bhopal.

**(10 × 1 = 10 Marks)**

P.T.O.

II. Answer **any eight**, each in a paragraph not exceeding **50** words. Each question carries **2** marks.

11. What is the condition put forth before the "great chief" by the Chief Seattle?
12. According to Tagore, what are the two different kinds of wisdom possessed by Vashishtha and Vishvamitra?
13. Comment on the line ". . . I reintroduced myself to myself, this time a mother".
14. "It was a spring without voices". Explain.
15. Describe the narrator's plot of land.
16. Suggest a few measures to reduce plastic pollution.
17. What is meant by "zero waste philosophy"?
18. Explain the concepts "Native species" and "Relic species".
19. What were the grievances of the villagers hit by the floods?
20. "A relief party came at last". Comment.
21. Who is Tasha?
22. Why was Saku determined to write the best assignment in class?
23. How should one deal with a bomb threat over the phone?
24. What is a man-made disaster? Explain with an example.
25. How did Arif Khan deal with the riotous mob of students?
26. What are the measures taken to ensure proper waste management in the relief camps?

**(8 × 2 = 16 Marks)**

III. Answer **any six** in a paragraph not exceeding **100** words. Each question carries **4** marks.

27. How do the red man's ways differ from those of the white man?
28. Tagore's description of the forest hermitage and the King's court.
29. What are the harmful effects of trophic cascade on the ecosystem?

30. What were the methods tried by the narrator's wife to solve the problem of the bats? Did she succeed?
31. Why is plastic so ubiquitous?
32. How does Satchidanandan present the bleak picture of the Chernobyl disaster?
33. What was Saku's assignment about?
34. Briefly explain the methods to mitigate the adverse impact of floods.
35. Examine the elements of sarcasm in Nissim Ezekiel's poem.
36. Discuss the experiences shared by the survivors of the Bhopal gas tragedy.
37. What is the medical emergency situation faced by Arif Khan? How does he manage to save the life of the person?
38. What are the things to be taken care of while setting up medical camps inside relief camps?

(6 × 4 = 24 Marks)

- IV. Answer **any two** of the following in not less than **300** words. Each question carries **15** marks.
39. Discuss the ecological concerns and environmental values raised by Chief Seattle in his speech.
  40. Explain how Indian Classical literature conceives ecology as mentioned by Tagore.
  41. Attempt a critical appreciation of Basheer's story.
  42. Gieve Patel's poem voices the anxiety over the mass destruction of trees. Analyse.
  43. What is the impact of plastic on the marine eco system?
  44. "The Truth about the Floods" reveals the agony of the victims of the floods and the apathy of the officials. Substantiate.

(2 × 15 = 30 Marks)

(Pages : 4)

M – 2144

Reg. No. : .....

Name : .....

**Second Semester B.A./B.Sc. Degree Examination, December 2021**

**First Degree Programme Under CBCSS**

**Language Course : Additional Language – Hindi**

**HN 1211.1 — HINDI NIBANDH AUR ANYA GADYA VIDHAYEN**

**(2020 Admission Regular)**

Time : 3 Hours

Max. Marks : 80

- I. निर्देश : एक शब्द या वाक्य में उत्तर लिखिए।
1. हिन्दी साहित्य के उपन्यास सम्राट कौन है?
2. 'बडौदा का अनुभव' किस विधा पर लिखी गई रचना है?
3. द्विवेदी जी के अनुसार देवदारु का पुराना नाम क्या है?
4. मनु भण्डारी कौन है?
5. 'बेटी का विवाह' किसकी रचना है?
6. तांडव नृत्य का प्रवर्तक कौन है?
7. मणिमधुकर का मूल नाम क्या है?
8. स्वाधीन भारत का संविधान किसने लिखा?

P.T.O.



9. हंस पत्रिका के सम्पादक कौन है?
10. 'निंदा सबद रसाल' किसका कथन है?

(10 × 1 = 10 Marks)

II. निर्देश : किन्हीं आठ प्रश्नों का उत्तर करीब 50 शब्दों में लिखिए।

11. देवताओं में कौन सबसे बड़ा ईश्यालू है? क्यों?
12. सिराम कौन है? उसे देखकर लेखक को क्या खयाल आता है?
13. जीवनी किसे कहते हैं?
14. मोबात कौन है?
15. निंदा रस में किसका चित्रण हुआ है?
16. 'गेहूँ और गुलाब' में मानव को क्या प्राप्त होता है?
17. दुष्यंतकुमार को, कमलेश्वर किस पोशाक में बदमाश लगते थे?
18. पारसी व्यवस्थापक ने अम्बेडकर को पहले सराय में ठहरने क्यों नहीं दिया?
19. 'क' के बारे में लेखक ई क्या राय है?
20. प्रेमचन्द ने अपनी बेटी को क्यों नहीं पढाया?
21. संस्मरण किसे कहते हैं?
22. गाँव में हाकिमों की जीपें क्यों आती थीं?
23. शिवजी का ध्यान भंग होने पर क्या हुआ?
24. लडकी का ब्याह जल्दी नहीं किया जाए तो समाज क्या-क्या टिप्पणियाँ करती है?
25. अम्बेडकर को बडौडा में रहने के लिए कहाँ जगह मिली?
26. राजेन्द्र यादव द्वारा रचित किन्हीं चार रचनाओं के नाम लिखिए।

(8 × 2 = 16 Marks)

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

27. लेखक के अनुसार देवदारु महावृक्ष नहीं है। कारण स्पष्ट कीजिए।
28. कन्यादान के प्रति मुंशी प्रेमचन्द का क्या अभिप्राय है?
29. लेखक की पडोसिन की बीमारी कैसे सुधर गई?
30. सिराम की तीसरी पत्नी का चित्रण कीजिए।
31. अम्बेडकर भारत लौटकर सीधे बडौदा क्यों आये?
32. 'हाँ हर कहानीकार को कहीं-न-कहीं झूठ को साधना पडता है' भाव समझाइए।
33. गेहूँ और गुलाब की प्रतीकात्मकता पर प्रकाश डालिए।
34. राजेन्द्र यादव की दृष्टि से कमलेश्वर कैसा व्यक्ति है?
35. मुंशी भवानी प्रसाद के चरित्र पर प्रकाश डालिए।
36. हजारी प्रसाद द्विवेदी के अनुसार मनोवैज्ञानिक और कला समीक्षक कौन-कौन है?
37. दिसावर और मऊ का अन्तर स्पष्ट कीजिए।
38. रामवृक्ष बेनीपुरी के अनुसार राक्षसता क्या है?

(6 × 4 = 24 Marks)

IV. निर्देश : किन्हीं दो प्रश्नों के उत्तर 250 शब्दों में लिखिए।

39. 'बेटी का विवाह' जीवनी पर प्रकाश डालिए।
40. 'मेरे हमदम मेरे दोस्त : कमलेश्वर' पाठ की समीक्षा कीजिए।
41. 'निंदा रस' का सारांश लिखिए।

42. 'सूखे सरोवर का भूगोल' में चित्रित गाँव और ग्रामवासियों का चित्रण कीजिए।
43. 'गेहूँ बनाम गुलाब' निबंध पर प्रकाश डालिए।
44. 'बडौदा का अनुभव' पाठ में अभिव्यक्त छुआछूत पर प्रकाश डालिए।

(2 × 15 = 30 Marks)

(Pages : 4)

M – 2336

Reg. No. : .....

Name : .....

**Second Semester B.Sc. Degree Examination, December 2021**

**First Degree Programme Under CBCSS**

**Mathematics**

**Foundation Course – II**

**MM 1221 : FOUNDATIONS OF MATHEMATICS**

**(2018 & 2019 Admission)**

Time : 3 Hours

Max. Marks : 80

**SECTION – I**

All the **first ten** questions are compulsory. They carry **1** mark each.

1. What is antecedent in a conditional statement?
2. Define tautology.
3. Give the negation of "S is compact and convex."
4. Express the statement "If  $x$  is greater than 1, then  $x^2$  is greater than 1" using quantifiers.
5. Define half-open Intervals.
6. Let  $L$  be the length of the curve  $x = \ln t, y = \sin t (1 \leq t \leq \pi)$ . Find an integral expression for  $L$ .
7. Write the formula for the area  $A$  of the region  $R$  enclosed by the polar curve  $r = f(\theta) (\alpha \leq \theta \leq \beta)$  and the lines  $\theta = \alpha$  and  $\theta = \beta$ .

P.T.O.

8. If  $v = \langle -2, 0, 1 \rangle$  and  $w = \langle 3, 5, -4 \rangle$ , the find  $w - 2v$ .
9. Express  $u \times v$  as a determinant.
10. Define trace of a surface in a plane.

**(10 × 1 = 10 Marks)**

### SECTION – II

Answer **any eight** questions from among the questions **11 to 22**. These questions carry **2** marks each.

11. Draw the truth table of the biconditional statement.
12. What are the two types of quantifiers?
13. Prove that  $(\sim p \Rightarrow c) \Leftrightarrow p$ .
14. Prove that  $A \cap (U \setminus B) = A \setminus B$ , where  $A$  and  $B$  be any two sets and  $U$  is the universal set.
15. Prove that  $(a, b) = (c, d)$  if and only if  $a = c$  and  $b = d$ .
16. Define equivalence relation. Give an example.
17. Eliminate  $t$  and establish a relation between  $x$  and  $y$ , given  $x = 2t - 3$ ,  $y = 6t - 7$ .
18. Find the slope of the tangent line to the unit circle  $x = \cos t$ ,  $y = \sin t$  at the point  $t = \frac{\pi}{6}$ .
19. Find the circumference of a circle having radius 'a' whose parametric equation is  $x = a \cos t$ ,  $y = a \sin t$ .
20. Find the center and radius of the sphere  $x^2 + y^2 + z^2 - 2x - 4y + 8z + 17 = 0$ .
21. Find a vector that is orthogonal to both of the vectors  $u = \langle 2, -1, 3 \rangle$  and  $v = \langle -7, 2, -1 \rangle$ .
22. Calculate the scalar triple product  $u \cdot (v \times w)$  of the vectors  $u = 3i - 2j - 5k$ ,  $v = i + 4j - 4k$ ,  $w = 3j + 2k$ .

**(8 × 2 = 16 Marks)**

### SECTION – III

Answer **any six** questions from among the questions 23 to 31. These questions carry **4** marks each.

23. Prove that  $p \Rightarrow q$  and  $\sim q \Rightarrow \sim p$  are logically equivalent.
24. Prove that "For every  $\varepsilon > 0$  there exists  $\delta > 0$  such that  $1 - \delta < x < 1 + \delta \Rightarrow 5 - \varepsilon < 2x + 3 < 5 + \varepsilon$ ".
25. Let  $f(x)$  be an integrable function. If  $\int_0^1 f(x) \neq 0$ , then prove that there exists an  $x$  in  $[0, 1]$  such that  $f(x) \neq 0$ .
26. Sketch the trajectory over the time interval  $0 \leq t \leq 10$  of the particle whose parametric equations of motion are  $x = t - 3 \sin t, y = 4 - 3 \cos t$ .
27. Without eliminating the parameter, find  $dy/dx$  and  $d^2y/dx^2$  at  $(1, 1)$  and  $(1, -1)$  on the semicubical parabola given by the parametric equations  $x = t^2, y = t^3$ .
28. Sketch the graph of the equation  $r = \sin \theta$  in polar coordinates by plotting points.
29. If  $u$  and  $v$  are nonzero vectors in 2-space or 3-space, and if  $\theta$  is the angle between them, then prove that  $\cos \theta = \frac{u \cdot v}{\|u\| \|v\|}$ .
30. Let  $v = \langle 2, 3 \rangle$ ,  $e_1 = \left\langle \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right\rangle, e_2 = \left\langle -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right\rangle$ . Find the scalar components of  $v$  along  $e_1$  and  $e_2$  and the vector components of  $v$  along  $e_1$  and  $e_2$ .
31. Find the orthogonal projection of  $v = j + j + k$  on  $b = 2i + 2j$ , and then find the vector component of  $v$  orthogonal to  $b$ .

**(6 × 4 = 24 Marks)**

SECTION – IV

Answer **any two** questions from among the questions 32 to 35. These questions carry **15** marks each.

32. Explain in detail, inductive reasoning and proof by counter example using the function  $f(n) = n^2 + n + 17$ .
33. (a) Prove that the countable union of countable sets is countable.  
(b) Prove that the set of all rational numbers is countable.
34. (a) Find the slope of the tangent line to the circle  $r = 4 \cos \theta$  at the point where  $\theta = \pi/4$ .  
(b) Find the arc length of the spiral  $r = e^\theta$  between  $\theta = 0$  and  $\theta = \pi$ .
35. (a) Suppose that two forces are applied to an eye bracket. Find the magnitude of the resultant and the angle  $\theta$  that it makes with the positive  $x$ -axis.  
(b) Find the angle between a diagonal of a cube and one of its edges.

**(2 × 15 = 30 Marks)**

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(Pages : 3)

M – 2140

Reg. No. : .....

Name : .....

**Second Semester B.A./B.Sc. Degree Examination, December 2021**

**First Degree Programme under CBCSS**

**Language Course V – Additional Language – Malayalam**

**ML 1211.1 : ഗദ്യസാഹിത്യം**

**(2018 & 2019 Admission)**

Time : 3 Hours

Max. Marks : 80

1. ഒരു വാക്കിലോ രണ്ടു വാക്യത്തിലോ ഉത്തരം എഴുതുക.
1. ഉറൂബ് എന്ന തൂലികാനാമത്തിൽ അറിയപ്പെടുന്നത് ആര്?
2. മലയാളത്തിലെ ലക്ഷണമൊത്ത ആദ്യത്തെ നോവൽ ഏത്?
3. സി.വി. രാമൻ പിള്ളയുടെ രണ്ട് ചരിത്ര നോവലിന്റെ പേരെഴുതുക.
4. ചെമ്മീൻ എന്ന നോവൽ എഴുതിയതാരം?
5. തലയുള്ള ചെറുക്കൻ എന്ന് നാട്ടുകാർ വിശേഷിപ്പിക്കുന്നതാരെ?
6. ക്ലാസ്സിൽ ഒന്നാം സ്ഥാനം അവൾക്ക് നിർബന്ധമായിരുന്നു, ആർക്ക്?
7. വെള്ളായിപ്പന്റെ ഗ്രാമത്തിന്റെ പേരെന്ത്?
8. മാനം നോക്കി പ്രസ്ഥാനം എന്നാൽ എന്ത്?

P.T.O.



9. നാലുകെട്ട് എന്ന നോവലിന്റെ കർത്താവാരാണ്?
10. നാലാമത്തെ പീരിയേഡ് ആയപ്പോൾ വിശപ്പ് തീ പോലെ ആളിപ്പടർന്നതാർക്ക്?

**(10 × 1 = 10 Marks)**

II. ഒരു ഖണ്ഡികയിൽ കവിയാതെ എട്ടു ചോദ്യത്തിന് ഉത്തരം എഴുതുക.

11. “ഒരു പെണ്ണ് രണ്ട് കുട്ടിയെ പ്രസവിക്കും പോലെ രണ്ടു പെണ്ണ് ഒരു കുട്ടിയെ പ്രസവിക്കുമോ?” ഈ ചോദ്യത്തിന്റെ പൊരുളെന്ത്?
12. വെള്ളായിയപ്പന്റെ യാത്രയുടെ ലക്ഷ്യം എന്തായിരുന്നു?
13. “പണത്തിന്റെയും വിദ്യാഭ്യാസത്തിന്റെയും വ്യാജമായ പരിവേഷങ്ങൾ അവർ രണ്ടുപേരും തങ്ങളുടെ ശിരസ്സിനു പിന്നിൽ പരസ്പരം ദർശിച്ചു” - വിശദീകരിക്കുക.
14. കാല്പനികത എല്ലാ സാഹിത്യ കാലഘട്ടത്തിലും ഉണ്ടായിരുന്നുവെന്ന് പറയാൻ കാരണമെന്ത്?
15. “മനസ്സിന്റെ ആട്ടം നിന്നതോടെ ആ ദൂർബ്ബലന്റെ കാൽപ്പെരുമാറ്റവും നിലച്ചു.” സന്ദർഭം വ്യക്തമാക്കുക.
16. മായൻ വയനാട്ടിൽ നിന്നും തിരിച്ചുവന്ന് ഉമ്മാച്ചുവിനെ പുനർവിവാഹം ചെയ്യാനിടയായ സാഹചര്യം എന്ത്?
17. കുട്ടികൃഷ്ണമാരാരുടെ നിരൂപണ രീതിയെപ്പറ്റിയുള്ള ഇ.എം.എസിന്റെ അഭിപ്രായം എന്ത്?
18. ലൂസി ജബ്ബാറിന്റെ വീട്ടിൽ അകപ്പെട്ടതെങ്ങനെ? വിശദമാക്കുക.
19. ഏതെന്ത് രോഗങ്ങളുമായി താരതമ്യം ചെയ്താണ് ക്യാൻസർ എന്ന രോഗത്തെ ലഘൂകരിച്ച് പറയുന്നത്?
20. നമ്മുടെ കാലം വാർത്താ സ്റ്റേഷനത്തിന്റെ കാലമാണെന്ന് പറയാൻ കാരണമെന്ത്?
21. ചെറിയപ്പന്റെ മരണത്തേക്കാൾ വീട്ടിലുള്ളവർക്ക് സങ്കടം ഉളവാക്കിയ സംഭവം എന്ത്?
22. “ഞങ്ങളുടെ ബലം മുഴുവൻ വിലാസിനിയാണ്” - ഇനിയൊരു കാലത്ത് ഒന്നാന്തരമൊരു വനിതാ വക്കീലാകേണ്ട ഞങ്ങളുടെ വിലാസിനി - സന്ദർഭവും ആശയവും വ്യക്തമാക്കുക.

**(8 × 2 = 16 Marks)**

III. 120 വാക്കിൽ കവിയാതെ ആറ് ചോദ്യത്തിന് ഉത്തരം എഴുതുക.

23. തെറ്റില്ലാത്ത മലയാളത്തെപ്പറ്റിയുള്ള ഇ.എം.എസിന്റെ അഭിപ്രായമെന്ത്?
24. പരമ്പരാഗത സദാചാരമൂല്യങ്ങളെ ഉമ്മാച്ചു അവഗണിക്കുന്നതെങ്ങനെ?
25. ഉരുപ്പാൻ മറ്റുള്ളവരുടെ മുൻപിൽ പരിഹാസ്യനാകുന്നതിന്റെ സാഹചര്യം വിശദീകരിക്കുക.
26. ഗീവർഗീസച്ചന്റെ സ്വഭാവ സവിശേഷതകളെന്തെല്ലാം?
27. ആരാന്റെ കൂട്ടി എന്ന കഥയിലെ ഹാസ്യതലം വിലയിരുത്തുക.
28. സരസ്വതിയമ്മയുടെ ജീവിതവീക്ഷണം പെൺബുദ്ധി എന്ന കഥയിൽ ആവിഷ്കൃതമാകുന്നത് എങ്ങനെ?
29. ചരിത്രകാരൻ അഹമ്മദുണ്ണിക്ക് നോവലിലുള്ള സ്ഥാനം അടയാളപ്പെടുത്തുക.
30. വെള്ളായിയപ്പന്റെ കണ്ണുതീലേക്കുള്ള യാത്ര വിവരിക്കുക.
31. ടെക്നോളജിയും ജനാധിപത്യവും തമ്മിലുള്ള ബന്ധത്തെപ്പറ്റി എം.എൻ. വിജയന്റെ നിരീക്ഷണം എന്ത്?

(6 × 4 = 24 Marks)

IV. മൂന്നു പുറത്തിൽ കവിയാതെ രണ്ടു ചോദ്യത്തിന് ഉത്തരം എഴുതുക.

32. വിധിയും സമൂഹവും സൃഷ്ടിക്കുന്ന ദുരന്തമാണ് 'ഉമ്മാച്ചു'വിൽ പ്രത്യക്ഷപ്പെടുന്നത് - ഉപന്യസിക്കുക.
33. വർത്തമാനകാലപ്രസക്തിയുള്ള രണ്ട് കഥകളാണ് 'തല്പ'വും 'ക്വഷ്ണഗാഥ'യും - ചർച്ച ചെയ്യുക.
34. ഒ.വി. വിജയന്റെ പ്രതിഭയുടെ പൂർണ്ണതയാണ് 'കടൽത്തീരത്ത്' - ഉപന്യസിക്കുക.
35. എം.ടി. വാസുദേവൻ നായരുടെ കഥകളുടെ പ്രത്യേകതകൾ പ്രതിഫലിക്കുന്ന കഥയാണ് 'കർക്കിടകം' - പ്രതിപാദിക്കുക.

(2 × 15 = 30 Marks)

(Pages : 4)

M – 2340

Reg. No. : .....

Name : .....

**Second Semester B.Sc. Degree Examination, December 2021**

**First Degree Programme Under CBCSS**

**Statistics**

**Complementary Course for Mathematics**

**ST 1231.1 : PROBABILITY AND RANDOM VARIABLES**

**(2020 Admission Regular)**

Time : 3 Hours

Max. Marks : 80

**SECTION – A**

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

1. Define sample space.
2. Define statistical regularity.
3. Prove that  $P(\phi) = 0$ .
4. If  $A$  and  $B$  are independent, then what is  $P(A/B)$  and  $P(B/A)$ ?
5. State the multiplication theorem of probability.
6. Define compound probability.
7. Give the definition of the distribution function of a two dimensional random vector.
8. Express variance in terms of conditional variance and conditional expectation.

P.T.O.

9. State the linearity property of expectation.
10. Define moment generating function associated with a random variable.

(10 × 1 = 10 Marks)

### SECTION – B

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

11. Distinguish between mutually exclusive and exhaustive events with examples.
12. For any two events  $A$  and  $B$  in the same sample space prove that
$$P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B).$$
13. Give the classical definition of probability and mention its drawbacks.
14. Define probability as a 'measure', explaining the term 'measure'.
15. What do you mean a probability space?
16. State the law of total probability.
17. If  $A$  and  $B$  are independent events then prove that  $A$  and  $B^c$  are independent and  $A^c$  and  $B$  are independent.
18. If  $A$ ,  $B$  and  $C$  are mutually independent, then prove that  $A \cup B$  and  $C$  are independent.
19. If the joint pdf of  $X$  and  $Y$  is  $p(x, y) = \frac{1}{22}(2x + 3y)$ ,  $x = 0, 1$  and  $y = 1, 2$  what is the joint distribution function?
20. Find the conditional pdf of  $X/Y$ , if the joint pdf of  $(X, Y)$  is  $f(x, y) = 2 - x - y$ ,  $0 < x, y < 1$ .
21. When do you say that two random variables are stochastically independent?
22. Define the concept of Transformation of one dimensional random variables.
23. Show that  $E(X) = E(E(X/Y))$ , with usual notations.

24. Write the expression for the  $r^{\text{th}}$  and  $s^{\text{th}}$  product moment about the origin of the bivariate random vector  $(X, Y)$ .
25. Give the Cauchy-Schwartz inequality.
26. Show that  $\phi_X(t)$  and  $\phi_X(-t)$  are complex conjugate functions, where  $\phi_X(t)$  is the characteristic function of the random variable  $X$ .

**(8 × 2 = 16 Marks)**

### SECTION – C

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

27. Give the axiomatic definition of probability.
28. Tom speaks truth in 30 percent cases and Jerry speaks truth in 25 percent cases. What is the probability that they would contradict each other?
29. Discuss the frequency/statistical definition of probability. Using this definition, prove that  $P(A^c) = 1 - P(A)$ .
30. Suppose  $A$ ,  $B$  and  $C$  are events such that  $P(A) = P(B) = P(C) = 1/4$ ,  $P(A \cap B) = 0 = P(B \cap C)$  and  $P(A \cap C) = \frac{1}{8}$ . Evaluate  $P(A \cup B \cup C)$ .
31. Each of the three guns has a probability 0.4 of hitting a target. What is the probability that (a) all will hit the target and (b) at least one will hit the target?
32. If  $p(x) = c \left(\frac{2}{3}\right)^x$ ,  $x = 1, 2, \dots$  is a probability mass function, (a) find  $c$  and (b)  $P(1 < X < 3)$ .
33. The joint pdf of a two dimensional random variable is  $f(x, y) = 2, 0 < x < 1; 0 < y < x$ .  
Then (a) find the marginal pdfs of  $X$  and  $Y$  and (b) check whether  $X$  and  $Y$  are independent
34. A continuous random variable  $X$  has the pdf  $f(x) = Ae^{-x/\theta}$ ,  $x > 0$ . (a) Find  $A$  and (b) for any two positive integers  $s$  and  $t$  prove that  $P(X > s + t | X > t) = P(X > s)$ .

35. If  $f(x) = 1, 0 < x < 1$ , find the pdf of  $Y = -2\log X$ .
36. A balanced die is rolled. If a person receives Rs. 10 when he gets an even number and loses Rs. 8 when he gets an odd number, how much money can he expect on an average in the long run.?
37. Let  $f(x, y) = 8xy, 0 < x < y < 1$ . Find (a)  $E(Y/X)$  and (b)  $V(Y/X)$ .
38. Mention the important properties of a characteristic function.

**(6 × 4 = 24 Marks)**

### SECTION – D

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

39. From a group of 8 children including 5 boys and 3 girls, three children are selected at random. What is the probability that (a) No girl (b) only one girl (c) one particular girl (d) at least one girl (e) More girls than boys are selected?
40. Prove or disprove: Mutual independence of three events implies pairwise independent. Is the converse true? Justify your claim.
41. (a) State and prove Baye's theorem.
- (b) Three identical boxes contain two balls each. One has both red, one has one red and one black and the third has two black balls. A person chooses a box at random and takes out a ball. If the ball is red and the probability that the other ball in the box is also red.
42. Let  $f(x, y) = \frac{1}{72}(2x + 3y), x = 0, 1, 2$  &  $y = 1, 2, 3$  be the joint pdf of  $(X, Y)$ . Then find (a) the distribution of  $X + Y$ , (b) the conditional distribution of  $X / X + Y = 3$  and (c) examine whether  $X$  and  $Y$  are independent or not.
43. Find the moment generating function of  $X$  with pdf  $f(x) = \frac{1}{\theta}, 0 < x < \theta$  and 0 elsewhere. Also compute the mean and the first 4 central moments.
44. Let  $X$  and  $Y$  have the joint pdf  $f(x, y) = \frac{x + 2y}{18}, x = 1, 2; y = 1, 2$ . Find the coefficient of correlation between  $X$  and  $Y$ .

**(2 × 15 = 30 Marks)**

(Pages : 3)

M – 2338

Reg. No. : .....

Name : .....

**Second Semester B.Sc. Degree Examination, December 2021.**

**First Degree Programme under CBCSS**

**Physics**

**Complementary Course for Mathematics**

**PY 1231.1 – THERMAL PHYSICS AND STATISTICAL MECHANICS**

**(2018 and 2019 Admission)**

Time : 3 Hours

Max. Marks : 80

**PART – A**

Answer **all** questions. Answer should not exceed **two** sentences.

Each question carries **1** mark.

1. Define the term Microstate with the help of an example.
2. Explain the term grand canonical ensemble.
3. State Clausius statement of second law of thermodynamics.
4. State equipartition of energy theorem.
5. What is diffusion?
6. Explain the term thermodynamic probability.
7. Define coefficient of performance. Is it greater than one? Explain
8. Explain the term Adiabatic Process.
9. What is the unit of entropy?
10. State Zeroth law of thermodynamics.

**(10 × 1 = 10 Marks)**

P.T.O.

## PART – B

Answer **any eight** questions. Answer should not exceed **one** small paragraph.

Each question carries **2** marks

11. Distinguish between Accessible and Inaccessible Macrostates.
12. Discuss Lee's disc method for finding the coefficient of thermal conductivity for bad conductors.
13. Deduce the expression for work done during isothermal processes.
14. Show that there is always an increase of entropy in an irreversible cycle.
15. What is an indicator diagram? State its importance.
16. What is the effect of pressure on thermal conductivity?
17. Derive the equation for adiabatic elasticity.
18. Explain the concept of entropy and available energy.
19. Explain the term Thermal Diffusivity or thermometric conductivity.
20. Discuss the distribution of energy in the spectrum of black body on the basis of the spectrum obtained in the experiment performed by Lummer and Pringsheim.
21. State the principle of increase of entropy.
22. Mention the physical significance and properties of entropy.

**(8 × 2 = 16 Marks)**

## PART – C

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

23. Calculate the surface temperature of sun and moon if the wavelength corresponding to the maximum intensity of radiations from them are  $4235 \text{ \AA}$  and  $15 \mu_m$  respectively (Wien's constant  $b = .2892 \times 10^{-2} \text{ mk}$ )
24. A quantity of air at  $27^\circ\text{C}$  and at atmospheric pressure is suddenly compressed to half its original volume. Find the final
  - (a) pressure and
  - (b) temperature. Given  $\gamma = 1.4$ .
25. Calculate the probability that in tossing a coin 5 times. we get 3 heads and 2 tails.



26. Calculate the radiant emittance of a black body at a temperature of
- (a) 400K
- (b) 4000K Given  $\sigma = 5.672 \times 10^{-8}$  M.K.S. units.
27. When 50gm of water is heated from 100C to 900C, by how much does its entropy change?
28. Compare the radiant emittance of a black body at 20K and 200K. Given  $\sigma = 5.672 \times 10^{-8}$  S units.
29. Find the efficiency of the Carnot's engine working between the steam point and the ice point.
30. A bar of length 30 cm and uniform area of cross section  $5 \text{ cm}^2$  consists of two halves AB of copper and BC of iron welded together at B. The end A is maintained at  $200^\circ\text{C}$  and the end C at  $0^\circ\text{C}$ . The sides of the bar are thermally insulated. Find the rate of flow of heat along the bar when the steady state is reached. Thermal conductivity of copper is 0.9 and thermal conductivity of iron is 0.12 CGS units.
31. Calculate the increase in entropy of 10kg of water at  $100^\circ\text{C}$  when it changes to vapour. Given Latent heat of steam = 540 cal/gram.

(6 × 4 = 24 Marks)

#### PART – D

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

32. Define solar constant. Describe an experiment to determine the solar constant using a pyr heliometer.
33. Show that the probability of a molecule to have its velocity component between  $v_x$ , and  $v_x + dv_x$  is given by  $P(v_x)dv_x = \left(\frac{m}{2\pi kT}\right)^{\frac{1}{2}} e^{-\frac{mv_x^2}{2kT}} dv_x$ .
34. What is T-S diagram? Find the expression for efficiency of a reversible Carnot's engine with the help of T-S diagram.
35. Calculate the work done in a Carnot's Cycle of operations. Deduce the efficiency of a Carnot's engine in terms of the temperatures between which it works.

(2 × 15 = 30 Marks)

(Pages : 6)

M – 2137

Reg. No. : .....

Name : .....

**Second Semester B.A./B.Sc./B.Com. Degree Examination, December 2021**

**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. and Career Related Group 2(a))**

**(2020 Admission Regular)**

Time : 3 Hours

Max. Marks : 80

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

1. Change the voice in the sentence.

Let them go.

2. Change the sentence "I love eating ice cream" into negative.

3. Supply the question tag for, "You are ok, ....."

4. Correct the following sentence.

I write fictions.

5. Begin the following sentence with it.

To write an essay is not easy.

6. Choose the correct verb form.

Trouble \_\_\_\_\_ (choose/chose) to follow the politician wherever he went.

P.T.O.

7. Identify if the following sentence is grammatically correct or not.  
The actor grew up as an only child.
8. Rewrite the sentence using the adverb provided.  
I am sad. (quite)
9. Complete the sentences with the correct option.  
They are two \_\_\_\_\_ of the same puzzle. (half/halves)
10. The majority of workers \_\_\_\_\_ not turned up for the strike. (has/have)

**(10 × 1 = 10 Marks)**

II. Answer any **eight** of the following questions as per instructions:

11. Convert the following into a compound sentence.
  - (a) I have an interview. I am late for it.
  - (b) The menagerie is far away. It is flooded.
12. Convert the following into a simple sentence.
  - (a) He is cop. It is true.
  - (b) Gopal is alone. He is still cheerful.
13. Correct the following sentences.
  - (a) Ritu shaked the pencil.
  - (b) He gave to me a pen holder.
14. Change the voice.
  - (a) We must take care of the puppy.
  - (b) Close the gate.
15. Fill in the blanks using the correct verb given in brackets.
  - (a) The boy has been \_\_\_\_\_ (missing/to miss) since last week.
  - (b) Unicorns \_\_\_\_\_ only in fairy tales. (exist/existed).

16. Choose the correct usage.
- (a) Half the shelf \_\_\_\_\_ (is/are) filled with organic products.
  - (b) Everyone \_\_\_\_\_ (has/have) duties.
17. Change into comparative degree:
- (a) His bike is as old as mine.
  - (b) Megha is the brightest student in the class.
18. Frame a question to get the underlined word as answer.
- (a) He is a critically acclaimed novelist.
  - (b) I am living in Melbourne since last year.
19. Add the correct question tag.
- (a) Everyone came to the movie premiere, \_\_\_\_\_ ?
  - (b) Buying a new house is a risky affair, \_\_\_\_\_ ?
20. Reorder the jumbled sentences.
- (a) Struggling dancer/been//have/a
  - (b) Went/hiking trip/they/on a
21. Choose the appropriate option to fill in the blanks.
- (a) The principal did not intend to discuss it any (further/farther)
  - (b) Ravi had done it with the \_\_\_\_\_ intentions in mind (best/better)
22. Rewrite into positive sentences.
- (a) I hate cooking.
  - (b) He does not like giving impromptu speeches.
23. Change into Direct speech.
- (a) She said that she had bought a new Audi.
  - (b) She said that she won the sweepstakes.

24. Change into exclamatory sentence.
- (a) The holiday ended with a bang.
  - (b) It was a great movie.
25. Write a conversation between two friends on a matter of importance.
26. Expand the following proverb:
- A Stitch in time saves nine.

**(8 × 2 = 16 Marks)**

III. Answer any **six**, as directed:

27. Prepare a questionnaire to assess the pattern of spending time online among teenagers.
28. Prepare a conversation between a teacher and a student who failed in a test paper.
29. Change the following conversation into Reported Speech:
- Zain: What are you doing?
- Cathy: Trying to prepare a quick lunch.
- Zain: Do you need my help?
- Cathy: Sure. Prep these ingredients for me!
30. Change the following into passive voice.
- (a) You can listen to the new song now.
  - (b) I saw a Banksy painting for sale at the auction.
  - (c) Somebody stole my purse.
  - (d) He gave the correct directions.

31. Fill up using articles:

She has bought \_\_\_\_\_ new watch for you \_\_\_\_\_ watch is very expensive. It is \_\_\_\_\_ smart watch with \_\_\_\_\_ latest features and \_\_\_\_\_ platinum strap.

32. Correct the following sentences.

- (a) Good friends is harder to come by these days.
- (b) I and you can clean this mess.
- (c) She is here since seven days.
- (d) He gave the speech herself.

33. Complete using suitable modals.

- (a) I \_\_\_\_\_ leave now, as I have to finish my homework. (should/would)
- (b) It \_\_\_\_\_ rain tomorrow. (may/have)
- (c) You \_\_\_\_\_ deliver the talk now. (must/should)
- (d) She \_\_\_\_\_ dance properly. (can, would)

34. Prepare a questionnaire to analyse the fitness routine of software professionals.

35. Rewrite using the adverbs provided.

- (a) He reaches office late. (generally)
- (b) Her judgement is on point. (mostly)
- (c) I am happy. (quite)
- (d) I have no regrets. (usually)

36. Fill up using suitable prepositions.

- (a) I go \_\_\_\_\_ the library every day.
- (b) The car fell \_\_\_\_\_ a ditch.
- (c) She was popular \_\_\_\_\_ old people.
- (d) He was sitting \_\_\_\_\_ me on the plane.

37. Fill up using suitable conjunctions.

- (a) The room was spic \_\_\_\_\_ span.
- (b) The child is strong \_\_\_\_\_ emotional.
- (c) Meena forgot whether to stay \_\_\_\_\_ leave.
- (d) Let me know \_\_\_\_\_ you reach the destination.

38. Attempt a dialogue between you and your teacher on how effective online exams were during the pandemic period.

**(6 × 4 = 24 Marks)**

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

39. Expand the proverb "A thing of beauty is a joy forever".

40. Write a report on the PTA meeting that took place in your college.

41. Write a short essay on the importance of health care workers during the pandemic.

42. Write a report on the importance of world peace.

43. Outline story.

Snake — middle of the night — scared — child scared — called mother — torch light — black rope — child happy — mother relieved.

44. Expand the proverb "A bird in hand is worth two in the bush".

**(2 × 15 = 30 Marks)**

(Pages : 6)

M – 2339

Reg. No. : .....

Name : .....

**Second Semester B.Sc. Degree Examination, December 2021**

**First Degree Programme under CBCSS**

**Mathematics**

**Foundation Course II**

**MM 1221 : FOUNDATIONS OF MATHEMATICS**

**(2020 Admission Regular)**

Time : 3 Hours

Max. Marks : 80

**PART – A**

All the **first** 10 questions are compulsory and each carries **1** mark :

1. Write the negation of the statement

“M is a cyclic subgroup”

2. Indicate whether the statement

“5 is not prime or 8 is prime” is true or false.

3. Rewrite the statement “There exists a number less than 7” using  $\exists$ ,  $\forall$  and  $\Rightarrow$ , as appropriate.

4. If  $A, B, C$  are subsets of a universal set  $U$ , then state whether the statement

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$  is true or false.

5. Write the parametric equation of semicubical parabola.

P.T.O.



6. Write the equation of parabola with focus  $(p, o)$  and directrix  $x = -p$ .
7. Which logical connective corresponds to the set relationship  $A \subseteq B$ ?
8. Find the dot product of the vectors  $\langle 3, 5 \rangle$  and  $\langle -1, 2 \rangle$ .
9. What is the general form of equation of a plane?
10. Describe the surface  $z = (x - 1)^2 + (y + 2)^2 + 3$ .

### PART – B

Answer **any eight** questions from questions 11 to 26. These questions carry **2** marks :

11. Write the truth table for  $p \vee q$ .
12. Identify the antecedent and consequent in the statement "If  $n$  is an integer, then  $2n$  is an even integer".
13. Provide a counter example to the statement "Every Continuous function is differentiable".
14. Write the contrapositive statement of the statement "continuity is a necessary condition for differentiability".
15. Let  $f: A \rightarrow B$  and  $g: B \rightarrow C$  be bijective. Then prove that  $g \circ f: A \rightarrow C$  is bijective.
16. State the reflection property of parabolas.
17. Determine a rotation angle  $\theta$  that will eliminate the  $xy$ -term in the equation  $2x^2 + xy + 2y^2 + x - y = 0$ .
18. Name the conic for which the set of points whose distance to the point  $(2, 3)$  is half the distance to the line  $x + y = 1$ .
19. Find the new coordinates of the point  $(2, 4)$  if the coordinate axes are rotated through an angle of  $\theta = 30^\circ$ .

20. Find the equation of the hyperbola with vertices  $(0, \pm 8)$  and asymptotes  $y = \pm \frac{4}{3}x$ .
21. Find the arc length of the spiral  $r = e^\theta$  between  $\theta = 0$  and  $\theta = \pi$ .
22. Find the parametric equations of the line passing through  $(4, 2)$  and parallel to  $v = \langle -1, 5 \rangle$ .
23. Calculate the scalar triple product  $u \cdot (v \times w)$  of the vectors  $u = 3\hat{i} - 2\hat{j} - 5\hat{k}$ ,  $v = \hat{i} + 4\hat{j} - 4\hat{k}$ ,  $w = 3\hat{j} + 2\hat{k}$ .
24. Show that  $u \times u = 0$  for any vector  $u$  in 3-space.
25. Find the vector of length 2 that makes an angle of  $\frac{\pi}{4}$  with the positive x-axis.
26. Find the distance  $d$  between the points  $(2, 3, -1)$  and  $(4, -1, 3)$ .

### PART - C

Answer **any six** questions from questions 27 to 38. These questions carry **4** marks each :

27. Construct a truth table for the compound statement  $\sim(p \wedge q) \Leftrightarrow [(\sim p) \vee (\sim q)]$
28. Use a truth table to verify that  $p \Rightarrow q$  and  $\sim q \Rightarrow \sim p$  are logically equivalent.
29. Let  $A = \{1, 2, 3, 4\}$  and  $B = \{2, 4, 6\}$  be subsets of the universal set  $U = \{1, 2, 3, 4, 5, 6\}$ . Then what is  $A \cup B$ ,  $A \cap B$ ,  $A \setminus B$  and  $U - B$ ?

30. Let  $A = \{1, 2, 3\}$  and  $B = \{2, 4, 6, 8\}$ . Which of the following relations are functions between  $A$  and  $B$ ?
- (a)  $\{(1, 2), (2, 6), (3, 4), (2, 8)\}$
- (b)  $\{(1, 4), (3, 8)\}$
- (c)  $\{(1, 6), (2, 6), (3, 2)\}$
- (d)  $\{(1, 8), (2, 2), (3, 4)\}$ .
31. Find the slope of the tangent line to the circle  $r = 4 \cos \theta$  at the point where  $\theta = \frac{\pi}{4}$ .
32. Find the area of the region that is inside the cardioid  $r = 4 + 4 \cos \theta$  and outside the circle  $r = 6$ .
33. Find an equation of the parabola that is symmetric about the  $y$ -axis, has its vertex at the origin and passes through the point  $(5, 2)$ .
34. Find the equations of the paraboloid  $z = x^2 + y^2$  in cylindrical and spherical coordinates.
35. Find the spherical coordinates of the point that has rectangular coordinates  $(x, y, z) = (4, -4, 4\sqrt{6})$ .
36. Sketch the graph of the parabola  $x^2 = 12y$ .
37. Describe the surface  $z = -(x^2 + y^2)$ .
38. The planes  $x + 2y - 2z = 3$  and  $2x + 4y - 4z = 7$  are parallel since their normals  $\langle 1, 2, -2 \rangle$  and  $\langle 2, 4, -4 \rangle$  are parallel vectors. Find the distance between these planes.

PART – D

Answer **any two** questions from questions 39 to 44. These questions carry **15** marks each :

39. Find examples of relations with the following properties.
- (a) Reflexive, but not symmetric and not transitive.
  - (b) Symmetric, but not reflexive and not transitive.
  - (c) Transitive but not reflexive and not symmetric.
  - (d) Reflexive and symmetric but not transitive.
  - (e) Reflexive and transitive but not symmetric.
40. (a) Let  $f:A \rightarrow B$  and  $g:B \rightarrow C$ . Using the ordered pair definition of the composition  $g \circ f$ , prove that  $g \circ f$  is a function and that  $g \circ f : A \rightarrow C$ .
- (b) Find an example of functions  $f:A \rightarrow B$  and  $g:B \rightarrow C$  such that
- (i)  $f$  and  $g \circ f$  are both injective but  $g$  is not injective.
  - (ii)  $g$  and  $g \circ f$  are both surjective but  $f$  is not surjective.
  - (iii)  $g \circ f$  is bijective but neither  $f$  nor  $g$  is bijective.
41. (a) Without eliminating the parameter, find  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$  at  $(1, 1)$  and  $(1, -1)$  on the semicubical parabola  $x = t^2$ ,  $y = t^3$  ( $-\infty < t < \infty$ ).
- (b) In a disastrous first flight, an experimental paper airplane follows the trajectory of a particle :
- $$x = t - 3 \sin t, y = 4 - 3 \cos t (t \geq 0)$$
- but crashes into a wall at time  $t = 10$ .
- (i) At what times was the airplane flying horizontally?
  - (ii) At what time was it flying vertically?

42. Sketch the graph of  $r = \cos 2\theta$  in polar coordinates, showing step by step the variation of  $\theta$  as follows :

$$0 \leq \theta \leq \frac{\pi}{4}, \frac{\pi}{4} \leq \theta \leq \frac{\pi}{2}, \quad \frac{\pi}{2} \leq \theta \leq \frac{3\pi}{4}, \quad \frac{3\pi}{4} \leq \theta \leq \pi, \quad \pi \leq \theta \leq \frac{5\pi}{4}, \quad \frac{5\pi}{4} \leq \theta \leq \frac{3\pi}{2},$$
$$\frac{3\pi}{2} \leq \theta \leq \frac{7\pi}{4}, \quad \frac{7\pi}{4} \leq \theta \leq 2\pi.$$

43. (a) Find the angle between the vectors  $u = \hat{i} - 2\hat{j} + 2\hat{k}$  and  $v = -3\hat{i} + 6\hat{j} + 2\hat{k}$ .
- (b) Find the angle between a diagonal of a cube and one of its edges.
- (c) Let  $v = \langle 2, 3 \rangle$ ,  $e_1 = \left\langle \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right\rangle$  and  $e_2 = \left\langle -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right\rangle$ . Find the scalar components of  $v$  along  $e_1$  and  $e_2$  and the vectors components of  $v$  along  $e_1$  and  $e_2$ .
44. (a) Find parametric equations of the line  $L$  passing through the points  $p_1(2, 4, -1)$  and  $p_2(5, 0, 7)$ .
- (b) Let  $L_1$  and  $L_2$  be the lines

$$L_1 : x = 1 + 4t, y = 5 - 4t, z = -1 + 5t$$

$$L_2 : x = 2 + 8t, y = 4 - 3t, z = 5 + t$$

Do the lines intersect?

(Pages : 4)

M – 2141

Reg. No. : .....

Name : .....

**Second Semester B.A./B.Sc. Degree Examination, December 2021**

**First Degree Programme under CBCSS**

**Language Course V – Additional Language – Malayalam**

**ML 1211.1 : ഗദ്യസാഹിത്യം**

**(2020 Admission - Regular)**

Time : 3 Hours

Max. Marks : 80

- I. ഒറ്റ വാക്കിലോ പരമാവധി രണ്ടു വാക്യത്തിലോ ഉത്തരമെഴുതുക.
1. കാമികന്റെ പണിപ്പുര എന്ന കൃതി ആരുടേതാണ്?
2. പുതിയ ലോകത്തിൽ ഒരു സുഖമേ പുതിയതായുള്ളൂ എന്നും അത് വേഗതയാണെന്നും പറഞ്ഞതാരാണ്?
3. 'പെനാൽറ്റി കാക്കുന്ന ഗോളിയുടെ ഉദ്ദേശം' എന്ന നോവൽ എഴുതിയതാര്?
4. 'തത്ത പറന്നിട്ട് പിന്നെ കൂടടച്ചിട്ടെന്താകാര്യം' - ആരുടെ വാക്കുകൾ?
5. ചോലമരങ്ങൾ ആരുടെ കഥയാണ്?
6. വെള്ളായിയപ്പൻ ഏതു കഥയിലെ കഥാപാത്രമാണ്?
7. വെളുത്ത ചീനമുളക് എന്ന വിളിപ്പേരുള്ള കഥാപാത്രം ഏത് നോവലിലേതാണ്?
8. കാരൂരിന്റെ കഥകളെ മനസ്സിലാക്കാനും എന്ന് വിശേഷിപ്പിച്ചതാര്?

P.T.O.

9. കെ. സുകുമാരന്റെ കഥകളെ മഹിളാളി മഹാസ്വദം എന്ന് വിശേഷിപ്പിച്ചതാരാണ്?
10. നിദ്രാടനം നടത്തുന്നവർ (The Sleep Walkers) എന്ന നോവലിന്റെ രചയിതാവ്?

**(10 × 1 = 10 Marks)**

II. ഒരു ഖണ്ഡികയിൽ കവിയാതെ ഏതെങ്കിലും എട്ടു ചോദ്യത്തിന് ഉത്തരമെഴുതുക.

11. അപരിചിതന്റെ സംഭാഷണം ഒരു കൊലക്കയറിനെപ്പോലെ വെള്ളായിയപ്പന്റെ കഴുത്തിൽ ചുറ്റി മുറുകി എന്ന് പറഞ്ഞിരിക്കുന്നതെന്തുകൊണ്ട്?
12. എന്താണ് കാല്പനികത?
13. 'നന്മയെ തടയുന്ന നാഗരികതയുടെ കാലത്ത് നന്ദികെട്ട ആളുകൾക്കിടയിൽ ആ വ്യഭാസനേത്രങ്ങൾ കവിഞ്ഞൊഴുകി' - ആരുടെ? എന്തുകൊണ്ട്?
14. 50 കളിൽ നെയ്ത്തിനെ പ്രോത്സാഹിപ്പിക്കാൻ രാജാജി പറഞ്ഞുകൊണ്ടിരുന്ന കഥയ്ക്ക് പുതിയ കാലത്ത് സംഭവിച്ച പരിണാമം എന്ത്?
15. ഗീവർഗീസ് അച്ഛന്റെ ഫുട്ബോൾ ഓർമ്മകൾ എന്തെല്ലാമാണ്?
16. നൗഷാദിനെ കുറിച്ചുള്ള ഡോ. പി.വി. ഗംഗാധരന്റെ ഓർമ്മകൾ എന്തെല്ലാം?
17. 'ആ ഓർമ്മയിൽത്തന്നെ അയാൾക്ക് യശോദയുടെ കോപവും താപവും വാത്സല്യവും മനസ്സിൽ നിറഞ്ഞു.' - ഏത് ഓർമ്മയിൽ? എന്തുകൊണ്ട്?
18. 'വെള്ളയടിച്ചിട്ടും പോകാത്ത ചില കരിംചുവപ്പെഴുന്ന കറകൾ ചുമരിൽ നിന്നും മിഴിച്ചു നോക്കുന്നത് ആ ദമ്പതികൾ കണ്ടില്ല.' - സന്ദർഭമെന്ത്?
19. ഫലിതം അതിന്റെ ഏറ്റവും ലാളിത്യത്തിൽ പ്രത്യക്ഷപ്പെടുന്നത് നമ്പ്യാരിലാണെന്ന് കെ.പി. അപ്പൻ സമർത്ഥിക്കുന്നതെങ്ങനെ?
20. 'ഇടി വെട്ടിയതിൽപ്പിന്നെ മഴ പെയ്യുന്നതു സാധാരണയാണെന്ന് പണ്ടൊരു പണ്ഡിതൻ പറഞ്ഞതാണ് അപ്പോൾ എനിക്കോർമ്മ വന്നത്.' സന്ദർഭം വ്യക്തമാക്കുക.

32. ഭരണാധികാരികൾക്ക് വിധേയമായിരിക്കേണ്ടതല്ലാത്തതെന്തെല്ലാം? (5)

സമത്വം

31. 'സമത്വം' എന്ന പദം എന്തെല്ലാം അർത്ഥങ്ങൾ ഉൾക്കൊള്ളുന്നു? (5)

സമത്വം

30. 'സമത്വം' എന്ന പദം എന്തെല്ലാം അർത്ഥങ്ങൾ ഉൾക്കൊള്ളുന്നു? (5)

സമത്വം

29. 'സമത്വം' എന്ന പദം എന്തെല്ലാം അർത്ഥങ്ങൾ ഉൾക്കൊള്ളുന്നു? (5)

സമത്വം

28. 'സമത്വം' എന്ന പദം എന്തെല്ലാം അർത്ഥങ്ങൾ ഉൾക്കൊള്ളുന്നു? (5)

27. 'സമത്വം' എന്ന പദം എന്തെല്ലാം അർത്ഥങ്ങൾ ഉൾക്കൊള്ളുന്നു? (5)

III. ന്യൂനപദങ്ങൾക്ക് അർത്ഥം നൽകുക. (5)

(8 x 2 = 16 Marks)

26. 'സമത്വം' എന്ന പദം എന്തെല്ലാം അർത്ഥങ്ങൾ ഉൾക്കൊള്ളുന്നു? (5)

25. 'സമത്വം' എന്ന പദം എന്തെല്ലാം അർത്ഥങ്ങൾ ഉൾക്കൊള്ളുന്നു? (5)

സമത്വം

24. 'സമത്വം' എന്ന പദം എന്തെല്ലാം അർത്ഥങ്ങൾ ഉൾക്കൊള്ളുന്നു? (5)

സമത്വം

23. 'സമത്വം' എന്ന പദം എന്തെല്ലാം അർത്ഥങ്ങൾ ഉൾക്കൊള്ളുന്നു? (5)

സമത്വം

22. 'സമത്വം' എന്ന പദം എന്തെല്ലാം അർത്ഥങ്ങൾ ഉൾക്കൊള്ളുന്നു? (5)

സമത്വം

21. 'സമത്വം' എന്ന പദം എന്തെല്ലാം അർത്ഥങ്ങൾ ഉൾക്കൊള്ളുന്നു? (5)



33. കൃഷ്ണനേയും കൃഷ്ണയേയും താദാത്മ്യപ്പെടുത്തിക്കൊണ്ട് കൃഷ്ണഗാഥ എന്ന കഥ മൂന്നോട്ടു പോകുന്നതിലെ സാംഗത്യം എന്ത്?
34. എഴുത്തുകാരൻ ഫലിതത്തിൽ നിന്ന് മൗനത്തിലേക്ക് നീങ്ങുന്നത് എപ്പോഴാണെന്നാണ് കെ.പി. അപ്പൻ സ്ഥാപിക്കുന്നത്?
35. കടൽത്തീരത്ത് എന്ന കഥയുടെ ആഖ്യാനത്തിലെ പ്രത്യേകതകൾ എന്തെല്ലാം?
36. കമല, കൊറിന അലാമില്ലൊ എന്നീ പെൺകുട്ടികൾ ഏതു തലത്തിലാണ് ഒന്നിക്കുന്നത്?
37. 'വാർത്തകൾ എത്തിക്കുകയാണ് മാധ്യമങ്ങളുടെ ലക്ഷ്യമെങ്കിലും ഇന്ന് അവയുടെ ഫലം ഇച്ഛകൾ ഉല്ലാദിപ്പിക്കുകയാണ്.' - വിശദീകരിക്കുക.
38. പുരോഗമനസാഹിത്യത്തിന്റെ കാലത്തെ നോവലുകളുടെ പ്രത്യേകതകൾ എന്തെല്ലാം?

**(6 × 4 = 24 Marks)**

**IV. മൂന്നു പുറത്തിൽ കവിയാതെ രണ്ടു ചോദ്യങ്ങൾക്ക് ഉത്തരമെഴുതുക.**

39. സമകാലിക മലയാള നോവലിൽ ആഖ്യാനത്തിലും പ്രമേയത്തിലും കൈവന്ന പുതുതകൾ എന്തെല്ലാമെന്ന് വിശദമാക്കുക.
40. 'ഉരുപ്പാന്റെ കിണർ' എന്ന കഥയുടെ സമകാലിക പ്രസക്തിയെന്താണെന്ന് പരിശോധിക്കുക.
41. ഇൻസാറുകൾ വർഷിക്കുന്ന ജ്ഞാനസൗന്ദര്യസ്വരൂപങ്ങൾ ലോകജനതയുടെ പൊതുവായ ഭക്ഷണമായിത്തീർന്നുകൊണ്ടിരിക്കുന്നു എന്ന് പ്രൊഫ. എം.എൻ. വിജയൻ സ്ഥാപിക്കുന്ന തെങ്ങനെ?
42. ആഖ്യാനത്തിന്റെയും പ്രമേയത്തിന്റെയും തലത്തിൽ മലയാള ചെറുകഥയിൽ സംഭവിച്ച രൂപപരിണാമങ്ങളെന്തെല്ലാമെന്ന് വിശദമാക്കുക.
43. ഉമ്മാച്ചു എന്ന നോവൽ കൈകാര്യം ചെയ്യുന്ന വിഷയങ്ങളും പ്രശ്നങ്ങളും വർത്തമാനകാല പരിസരത്തിൽ നിന്നു ചർച്ച ചെയ്യുക.
44. പെൺബുദ്ധി എന്ന കഥയിൽ നിന്ന് പുതിയ കാലത്തെത്തുമ്പോൾ സ്ത്രീകളെ പ്രമേയമാക്കുന്ന കഥയ്ക്ക് സംഭവിച്ച പരിണാമങ്ങളെന്തെല്ലാമാണെന്ന് കണ്ടെത്തുക.

**(2 × 15 = 30 Marks)**