Bsc maths

(Pages : 3) **T – 2288**

**Reg. No. : .....**

**Name : .....**

**Fourth Semester B.A./B.Sc. Degree Examination, July 2024**

**First Degree Programme under CBCSS**

**Language Course – English**

**EN 1411.1/EN 1411.3 : READINGS IN LITERATURE**

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

**(2019 Admission Onwards)**

Time : 3 Hours Max. Marks : 80

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

1. What is the question the poet asks the labourers of England?
2. List the main themes of "The Gift Outright".
3. What is the central theme of "Telephone Conversation"?
4. What is the meaning of the word 'interior' in Atwood's poem?
5. What does the sound of the flute signify in "House of a Thousand Doors"?
6. Why is the colour yellow associated with the Indian bride?
7. Theme of "The Exercise Book".
8. How did the narrator understand that his liver was out of order?
9. What does "You are Under Surveillance" talk about?
10. Who was Kochuraman in "The Power of Faith"?

**(10 × 1 = 10 Marks)**

P.T.O.

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

11. What are the things the poor labourers do not get although they work very hard?

12. What helped Frost establish his reputation as a truly national poet?

13. The protagonists of "Telephone Conversation".

14. What does 'The House of a Thousand Doors' symbolize?

15. Comment on card in the poem "Identity Card".

16. What did the white men do to the aboriginals according to Oodgeroo Noonuccal?

17. What does "Agony" depict?

18. The sad fate of Uma in "The Exercise Book".

19. The attitude of Krishnan's daughter to her grandmother.

20. The character of Lomov.

21. What effect did John Kurian's notice about the surveillance camera have on his daughter Sini?

22. What is Arundhati Roy's first comment on nuclear weapons?

**(8 × 2 = 16 Marks)**

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

23. What does Frost's "The Gift Outright" convey?

24. Write a note on the aesthetics of "I cannot help blossoming".

25. How does Atwood describe her journey to the interior?

26. How does the poem "We are Going" end?

27. Why did Krishnan refuse to help his sister when she was ill?

28. The disease of the protagonist in "The Man Who was a Hospital".

29. What was peculiar in the character of Natalya Stepanovna?

30. What does Malcolm X say about Marcus Garvey?

31. What is Arundhati Roy's opinion about the common people of India?

**(6 × 4 = 24 Marks)**

IV. Answer any **two**, each in about **300** words.

32. What is Shelley's exhortation to the men of England?

33. "The Exercise Book" as the story of the sad predicament of the Indian girl child.

34. Chekhov's use of humour and exaggeration in "A Marriage Proposal'.

35. What does Arundhati Roy say about India's last nuclear test?

**(2 × 15 = 30 Marks)**

mths

(Pages : 4) **T – 2521**

**Reg. No. : .....**

**Name : .....**

**Fourth Semester B.Sc. Degree Examination, July 2024**

**First Degree Programme under CBCSS**

**Statistics**

**Complementary Course for Mathematics**

**ST 1431.1 : STATISTICAL INFERENCE**

**(2022 Admission)**

Time : 3 Hours Max. Marks : 80

SECTION – A

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

1. State sufficient condition for consistency of an estimator.
2. Define confidence interval.
3. The 95 % confidence interval for mean of a normal population $N(\mu,\sigma)$ is _____
4. Define simple hypothesis.
5. What is a null hypothesis?
6. Define power of a test.
7. Write the test statistic of $\chi^2$ test for goodness of fit.
8. What is p value?
9. How will you find the correction factor in the calculation of sum of squares?
10. Which test is applied in ANOVA technique?

**(10 × 1 = 10 Marks)**

P.T.O.

## SECTION – B

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

11. Find the maximum likelihood estimate (mle) of $\lambda$ in Poisson $\lambda$ population.

12. Show that the sample mean is a sufficient estimator of $p$ when samples of size $n$ are taken from Binomial population with parameters $N$ and $p$.

13. 150 heads obtained from 400 tosses of a coin. Find a 90% confidence interval for the proportion of heads.

14. State Neyman - Pearson lemma.

15. Distinguish between type I and type II errors.

16. What do you mean by a large sample test?

17. In a sample of size 100, there are 65 individuals in the category of interest. It is decided to test the null hypothesis $H0 : p = 0.70$ *Vs* $H1 : < 0.70$. Compute the value of test statistic.

18. For a random sample of size 20 from a normal population, the mean is 12.1 and the standard deviation is 3.2. Is it reasonable to suppose that the population mean is 14.5? Test at 5% significance level.

19. Give a situation where test for proportion is suitable.

20. Explain important uses of Chi – square distribution.

21. List the assumptions of ANOVA test.

22. What are the principles of design of experiments?

**(8 × 2 = 16 Marks)**

## SECTION – C

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

23. Explain the difference between point estimation and interval estimation.

24. Explain the method of constructing confidence interval for the variance of a normal population.

25. If $X > 1$ is the critical region for testing $H_0 : \theta = 2$ against $H_1 : \theta = 1$ on the basis of single observation from the population $f(x;\theta) = \theta e^{-\theta x}, x > 0$, find the probability of type 1 and type two errors.

26. In tossing of a coin, let the probability of turning up a head be $p$. The hypotheses are $H_0 : p = 0.4 \; vs \; H_1 : p = 0.6$. $H_0$ is rejected if there are 5 or more heads in 6 tosses. Find the power.

27. In a sample of 600 men from city A, 450 are found to be smokers. Out of 900 from city B, 450 are smokers. Do the data indicate that the cities are significantly different with respect to prevalence of smoking.

28. Explain $F$ test for equality of variances.

29. Suppose that 64 senior girls from College A and 81 senior girls from College B had mean statures of 68.2" and 67.3" respectively. If the standard deviation for statures of all senior girls is 2.43, is the difference between the two groups significant?

30. Explain the different stages of conducting one way ANOVA.

31. What is the difference between a one-way ANOVA and a two-way ANOVA?

**(6 × 4 = 24 Marks)**

## SECTION – D

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

32. (a) Examine whether the sample variance is an unbiased estimator of the population variance for a normal population $N(\mu, \sigma)$.

(b) $X_1, X_2$ and $X_3$ is a random sample of size 3 from a population with mean value $\mu$ and variance $\sigma^2$. $T_1, T_2, T_3$ are the estimators used to estimate $\mu$, where $T_1 = X_1 + X_2 - X_3$, $T_2 = 2X_1 + 3X_2 - 4X_3$ and $T_3 = \dfrac{\lambda X_1 + X_2 + X_3}{3}$.

(i) Are $T_1$ and $T_2$ unbiased estimators?

(ii) Find the value of $\lambda$ such that $T_3$ is unbiased for $\mu$.

(iii) With this value of $\lambda$ is $T_3$ a consistent estimator.

(iv) Which is the best estimator?

33. (a) Explain paired t test.

(b) Test scores before and after a coaching programme are given below. Test at 5% level of significance whether coaching was effective or not.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Before | 50 | 52 | 53 | 60 | 65 | 67 | 48 | 69 | 72 | 80 |
| After | 65 | 55 | 65 | 65 | 60 | 67 | 49 | 82 | 74 | 86 |

34. (a) Explain the Chi square test of independence of two attributes.

(b) A driving school examined the result of 200 candidates who were taking their driving test for the first time. They found that, out of the 90 men, 52 passed and out of the 110 women, 59 passed. Do these results indicate at 1% level of significance a relationship between the sex of the candidate and the ability to pass the first time?

35. The table below shows the lifetimes under controlled conditions, in hours in excess of 1000 hours, of samples of 60W electric light bulbs of three different brands.

| Brand | | |
|---|---|---|
| 1 | 2 | 3 |
| 16 | 18 | 26 |
| 15 | 22 | 31 |
| 13 | 20 | 24 |
| 21 | 16 | 30 |
| 15 | 24 | 24 |

Assuming all lifetimes to be normally distributed with common variance, test, at the 1% significance level, the hypothesis that there is no difference between the three brands with respect to mean lifetime.

**(2 × 15 = 30 Marks)**

(Pages : 4) **T – 2523**

**Reg. No. : .....**

**Name : .....**

**Fourth Semester B.Sc. Degree Examination, July 2024**

**First Degree Programme under CBCSS**

**Physics**

**Complementary Course for Mathematics**

**PY 1431.1 : MODERN PHYSICS AND ELECTRONICS**

**(2018 Admission onwards)**

Time : 3 Hours Max. Marks : 80

SECTION – A

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

1. What is binary coded decimal?

2. Does the pair of atoms ${}_6C^{14}$, ${}_8O^{16}$ represent isotones? Explain.

3. If the mean-life of a radioactive element is 200 days what is its half-life?

4. What is the speciality of Neptunium series?

5. Which are the distinct features of vector atom model?

6. Give experimental evidence which was essential for the development of quantum mechanics.

7. An eigenvalue equation is represented by $H\psi = E\psi$ Name the terms involved.

P.T.O.

8. Schematically represent a pn junction connected in forward and reverse bias.

9. What is thermal runaway?

10. Draw the output wave form of half wave rectifier with an input sine wave.

**(10 × 1 = 10 Marks)**

SECTION – B

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

11. Prove that $(a+b)'+(a+b)'=a'$

12. Subtract 1001 from 1101 using 1's complement and 2's complement methods.

13. Mention the properties of nuclear forces.

14. Give the vector representation of magnetic total angular momentum quantum number for 1=1.

15. Explain spin-orbit coupling.

16. Differentiate between transient and secular equilibrium.

17. What were the assumptions made by Planck for formulating radiation law?

18. What is a wave-function? Explain its significance.

19. What break down voltage? Is it possible to make a pn junction with a given breakdown voltage? Explain.

20. Differentiate between an ordinary diode and zener diode.

21. Draw the output characteristics of common emitter configuration and specify the regions.

22. Explain the working of npn transistor.

**(8 × 2 = 16 Marks)**

## SECTION – C

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

23. Which are the universal gates? Why are they called so? Write their truth table and draw the symbols.

24. Explain and illustrate Pauli's exclusion principle.

25. Determine the wavelength of the electromagnetic wave emitted when the electronic transition from *L* to *K* shell occurs in hydrogen atom.

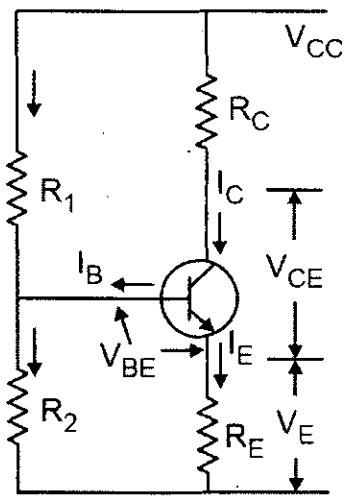
26. Determine the binding energy of the triton (tritium nucleus). Given $m_p = 1.007276$ u, $m_n = 1.008665$ u and $m_t = 3.01604928$ u.

27. Compare time dependent and time independent Schrodinger equations.

28. 200-0-200 V (rms) is applied to the diodes of a full wave rectifier with 1 $k\Omega$ load. Neglecting the diode resistance calculate average dc voltage and current.

29. Show that the three transistor currents are in the ratio $I_E : I_B : I_C :: 1 : (1-\alpha) : \alpha$

30. A transistor working in the potential divider bias method has the following parameters. $V_{CC} = 12$ V, $R_1 = 50\,k\Omega$, $R_2 = 10k\Omega$, $R_E = 1k\Omega$. Determine $I_C$ for Ge and Si transistors which have $V_{BE}$ =0.3 V and 0.7 V respectively.




31. In CE configuration of transistor with $V_{CC}$ = 10 V and $R_C$= $4k\Omega$, draw the dc load line. Determine the Q point if zero signal base current is 10 $\mu A$ and $\beta$ =50.

**(6 × 4 = 24 Marks)**

## SECTION – D

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

32. Perform the following conversions.

(a) $(19.125)_{10}$ to binary.

(b) $(187.09375)_{10}$ to octal.

(c) $(23717.3875)_{10}$ to hexadecimal.

(d) $(245.43)_{8}$ to binary and hexadecimal.

(e) $(7AE.AEF)_{16}$ to binary and decimal.

33. Discuss the general properties of nucleus.

34. Apply Schrodinger equation for a particle in a box and obtain and plot the expressions for first three normalized wave-functions and energy levels.

35. Analyse the working of the practical circuit of a common emitter amplifier and discuss the major parameters.

**($2 \times 15 = 30$ Marks)**

(Pages : 3) **T – 2295**

**Reg. No. : .....**

**Name : .....**

**Fourth Semester B.A./B.Sc. Degree Examination, July 2024**

**First Degree Programme under CBCSS**

**Language Course : Additional Language – Hindi**

**HN 1411.1 – HINDI : KAVITA EVAM EKANKI**

**(2020 Admission onwards)**

Time : 3 Hours Max. Marks : 80

I. एक या दो वाक्यों में उत्तर लिखिए –

1. 'भाषा की मिठास' नामक कविता के रचयिता कौन हैं?
2. छायावाद के सुकुमार कवि कौन हैं?
3. 'बीजक' के कितने भाग हैं?
4. महादेव और बलदेव किस एकांकी के पात्र हैं?
5. सूरदास की अक्षयकीर्ति का आधार कौन सी रचना हैं?
6. चकोरी की माँ का नाम क्या है?
7. 'रामचरितमानस' के रचयिता कौन हैं?
8. 'भिक्षुक' की रचना किन्होंने की थी?
9. 'छोटी मछली बड़ी मछली' नामक एकांकी के रचयिता कौन हैं?
10. 'बबूल के नीचे सोता बच्चा' किस कवि की कविता है?

**(10 × 1 = 10 Marks)**

P.T.O.

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

11. 'दस मिनट' नामक एकांकी का सन्देश व्यक्त करें।

12. कात्यायनी के मत में औरत के सामने घर कैसा था?

13. हिन्दी साहित्य में ममता कालिया का स्थान क्या है?

14. 'भाषा की मिठास' नामक कविता में व्यक्त विचार क्या है?

15. स्वदेश दीपक के साहित्यिक अवदान क्या-क्या हैं?

16. एक प्रतीकात्मक कविता है 'टूटा पहिया' - स्पष्ट करें।

17. रामकुमार वर्मा का परिचय दें।

18. रहीम के चार ग्रंथों के नाम लिखिए।

19. डॉ. कौशिक कौन है?

20. पंत की 'नौका विहार' नामक कविता में की गई प्राकृतिक वर्णना का परिचय दें।

21. अनामिका ने 'नमक' नामक कविता में कौन सा सन्देश व्यक्त किया है?

22. 'छोटी मछली बड़ी मछली' में प्रयुक्त व्यंग्य पर प्रकाश डालिए।

**(8 × 2 = 16 Marks)**

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

23. 'बबूल के नीचे सोता बच्चे' में कवि क्या सन्देश देना चाहते हैं?

24. 'चरण-कमल बंदौ हरि राई।
जाकि कृपा पंगु गिरी लघे, अंधे को सब कुछ दरसाई।।
बहिरौ सुनै मूक पुनि बोलै, रंग चलै सिर छत्र धराई।
सूरदास स्वामी करुणामय, बार-बार बंदौ तेहि पाई।।' - व्याख्या कीजिए।

25. उदयप्रकाश की साहित्यिक सेवाओं पर प्रकाश डालिए।

26. 'भरोसा' नामक कविता में व्यक्त विचार पर प्रकाश डालिए।

27. 'रहीम के दोहे आदर्श और नीति के वाहक हैं' – इस कथन का समर्थन कीजिए।

28. 'भिक्षुक' कविता की प्रासंगिकता क्या है?

29. 'दया धर्म का मूल है, पाप मूल अभिमान।
तुलसी दया न छोड़िए जब लोग घाट में प्राण।।' – सप्रसंग व्याख्या कीजिए।

30. कवयित्री अनामिका का परिचय दें।

31. कवि धर्मवीर भारती अपनी 'टूटा पहिया' नामक कविता के माध्यम से क्या सन्देश देना चाहते हैं?

**(6 × 4 = 24 Marks)**

**IV. किन्हीं दो प्रश्नों के उत्तर करीब 250 शब्दों में लिखिए।**

32. 'छोटी मछली बड़ी मछली' नामक एकांकी में एकांकीकार कौनसा सन्देश देना चाहते हैं? आलोचना कीजिए।

33. 'कबीरदास हिन्दी साहित्य के महान कवि ही नहीं बल्कि बड़े समाज सुधारक भी थे' – प्रस्तुत कथन की आलोचना कीजिए।

34. 'शादी की बात' नामक एकांकी का सारांश लिखकर उद्देश्य व्यक्त करें।

35. 'पिता' नामक कविता का सारांश लिखकर उसकी समीक्षा कीजिए।

**(2 × 15 = 30 Marks)**

(Pages : 4) **T – 2292**

**Reg. No.** : .....

**Name** : .....

## Fourth Semester B.A./B.Sc. Degree Examination, July 2024

## First Degree Programme under CBCSS

## Language Course – Additional Language – Malayalam

## ML 1411.1 : ദൃശ്യകലാസാഹിത്യം

## (2021 Admission Onwards)

Time : 3 Hours Max. Marks : 80

I. ഒരു വാക്കിലോ വാക്യത്തിലോ ഉത്തരമെഴുതുക.

1. കോട്ടയംകൃതികൾ എന്നറിയപ്പെടുന്ന ആട്ടക്കഥളേതൊക്കെ ?

2. നിവാതകവചകാലകേയവധം ആരുടെ കൃതിയാണ് ?

3. കല്ല്യാണസൗഗന്ധികം ഏത് തുള്ളൽ വിഭാഗത്തിൽപ്പെടുന്നു ?

4. 'കാന്താരതാരകം' ഏതു കൃതിയുടെ വ്യാഖ്യാനമാണ് ? ഗ്രന്ഥകർത്താവ് ആര് ?

5. പറയൻ തുള്ളൽ വിഭാഗത്തിൽ ഉൾപ്പെടുന്ന കൃതിയേത് ?

6. സദാരാമ എഴുതിയതാര് ? സാഹിത്യചരിത്രത്തിലുള്ള പ്രാധാന്യമെന്ത് ?

7. മലയാളത്തിലെ ആദ്യ സാമൂഹികപരിഷ്കരണ നാടകം.

P.T.O.

8. തനതുനാടകങ്ങൾ ഏതെല്ലാം ?

9. മലയാളത്തിലെ ആദ്യ ശബ്ദചിത്രം ഏത് ?

10. 'മഴ' എന്ന സിനിമ ഏതു കൃതിയെ അടിസ്ഥാനമാക്കിയാണ് ആവിഷ്കരിച്ചിട്ടുള്ളത് ?

**(10 × 1 = 10 Marks)**

II. **അമ്പതു** വാക്കിൽ കവിയാതെ **എട്ടു** ചോദ്യത്തിന് ഉത്തരമെഴുതുക.

11. കഥകളിയുമായി ബന്ധപ്പെട്ട ചടങ്ങുകൾ പരിചയപ്പെടുത്തുക.

12. 'വിഫലാനി വോ വരഫലാനി കാനി'? ആര്, ആരോട് ചോദിക്കുന്നതാണ് ? സന്ദർഭം വ്യക്തമാക്കുക.

13. 'എലിയെപ്പോലെയിരിക്കുന്നവനൊരു

പുലിയെപ്പോലെ വരുന്നതു കാണാം'

- ആരെക്കുറിച്ചാണ് സൂചിപ്പിക്കുന്നത് ? സന്ദർഭം വിശദമാക്കുക.

14. ആദ്യകാല നാടക പരിഭാഷകളെ പരിചയപ്പെടുത്തുക.

15. ലെനിൽ രാജേന്ദ്രന്റെ സിനിമകളേതെല്ലാം?

16. ഓട്ടൻതുള്ളൽ - കുറിപ്പെഴുതുക.

17. അനുവർത്തനം എന്നാലെന്ത്?

18. സംഗീതനാടകങ്ങളുടെ സവിശേഷതകൾ എന്തെല്ലാം?

19. ആട്ടക്കഥാസാഹിത്യം - കുറിപ്പെഴുതുക.

20. തനതു നാടകവേദിയെ പരിചയപ്പെടുത്തുക.

21. തിരക്കഥ എന്നാലെന്ത്?

22. സിനിമ എന്ന കലാരൂപത്തിന്റെ വ്യതിരിക്തതകൾ എന്തെല്ലാം?

**(8 × 2 = 16 Marks)**

III. **നൂറു** വാക്കിൽ കവിയാതെ **ആറു** ചോദ്യത്തിന് ഉത്തരമെഴുതുക.

23. "യുദ്ധം ചെയ്തു തളർച്ച വരുമ്പോൾ

ബുദ്ധിയിൽ നല്ല വിവേകവുമുണ്ടാം"

- സന്ദർഭം വിശദീകരിക്കുക.

24. 'നയവും ജയവും ഭയവും വ്യയവും

നാടുഭരിപ്പവരോടു നടപ്പതു' ആശയം വ്യക്തമാക്കുക.

25. ആട്ടക്കഥയും നാടകവും ദൃശ്യകലയെന്ന നിലയിൽ വ്യത്യാസപ്പെട്ടിരിക്കുന്നതെങ്ങനെ?

26. മഴ സിനിമയുടെ ദൃശ്യവൽക്കരണത്തെക്കുറിച്ച് വിവരിക്കുക.

27. സ്വപ്നവാസവദത്തം പരിഭാഷകളിൽ നിന്നും പന്മന രാമചന്ദ്രൻ നായരുടെ പരിഭാഷ വ്യതിരിക്തമാകുന്നുണ്ടോ? വിശദീകരിക്കുക.

28. അടുക്കള സ്ത്രീപക്ഷ നാടകമാകുന്നതെങ്ങനെ? സാധൂകരിക്കുക.

29. നളചരിതത്തിലെ ഭാഷാപരമായ സവിശേഷതകളെന്തെല്ലാം?

30. കിരാതം ഓട്ടൻതുള്ളലിന്റെ ഭാഷാസവിശേഷതകളെ ക്രോഡീകരിക്കുക.

31. നളചരിതം മൂന്നാം ദിവസത്തിലെ നളന്റെ ചിന്തകൾ തത്ത്വചിന്താപരമാണ്. പരിശോധിക്കുക.

**(6 × 4 = 24 Marks)**

IV. **മൂന്നുവു** വാക്കിൽ കവിയാതെ **രണ്ട്** ചോദ്യത്തിന് ഉത്തരമെഴുതുക.

32. ഉണ്ണായിവാര്യരുടെ നളചരിതം ആട്ടക്കഥയുടെ സവിശേഷത വ്യക്തമാക്കുക.

33. കേരളീയമായ സാമൂഹ്യപശ്ചാത്തലം കുഞ്ചൻ നമ്പ്യാരുടെ കൃതികളിൽ അനാവരണം ചെയ്യപ്പെടുന്നുണ്ടോ? പരിശോധിക്കുക.

34. മലയാളത്തിലുണ്ടായിട്ടുള്ള അനുവർത്തന സിനിമകൾ മലയാളസിനിമയുടെ ചരിത്രത്തെ സ്വാധീനിച്ചതെങ്ങനെ?

35. കേരളത്തിന്റെ ദൃശ്യകലാപാരമ്പര്യത്തെ സാമാന്യമായി പരിചയപ്പെടുത്തുക.

**(2 × 15 = 30 Marks)**

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**Reg. No. : .....**

**Name : .....**

**Fourth Semester B.Sc. Degree Examination, July 2024**

**First Degree Programme under CBCSS**

**Mathematics**

**MM 1441 : ELEMENTARY NUMBER THEORY AND CALCULUS – II**

**(2018 Admission Onwards)**

Time : 3 Hours Max. Marks : 80

SECTION – A

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

1. Find the remainder when $16^{53}$ is divided by 7.

2. Determine whether the linear congruence $16x \equiv 18 \pmod{12}$ is solvable.

3. Find an inverse of 5 modulo 7.

4. Determine whether $N = 54, 893, 534, 046$ is a square.

5. State chinese Remainder theorem.

6. Evaluate $\int_0^1 \int_{x^2}^{x} dA$.

7. Find the limits of integration $\int\int_R (3x - 2y)\, dA$ where $R$ is the region bounded by the circle $x^2 + y^2 = 1$.

P.T.O.

8. Write the converting formula for 3-dimensional Cartesian to spherical coordinates.

9. Show that $\phi(x,y,z) = x^2 - 3y^2 + 4z^2$ is a potential function for the vector field $\vec{F}(x,y,z) = 2x\hat{i} - 6y\hat{j} + 8z\hat{k}$.

10. State the fundamental theorem of line integrals.

**(10 × 1 = 10 Marks)**

SECTION – B

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

11. If $a \equiv b \pmod{m}$ and $c \equiv d \pmod{m}$, then show that $(a - c) \equiv (b - d) \pmod{m}$.

12. Solve the congruence $49x \equiv 84 \pmod{35}$.

13. Using casting out nines, check if the sum of the numbers 3569, 24387 and 49508 is 78464.

14. Show that a positive integer $a$ is self invertible modulo $p$ if and only if $a \equiv \pm 1 \pmod{p}$.

15. Evaluate $\int_1^2 \int_0^4 2xy \, dy \, dx$.

16. Use a double integral to find the volume of the solid that is bounded above by the plane $z = 4 - x - y$ and below by the rectangle $R = [0, 1] \times [0, 2]$.

17. Evaluate $\iint_R e^{-(x^2+y^2)} \, dA$ where $R$ is the region enclosed by the circle $x^2 + y^2 = 1$.

18. Find the surface area of that portion of paraboloid $z = x^2 + y^2$ below the plane $z = 1$.

19. Evaluate the triple integral $\iiint_G 12xy^2z^3\,dV$ over the rectangular box $G$ defined by the inequalities $-1 \le x \le 2, 0 \le y \le 3, 0 \le z \le 2$.

20. Find the curl of the vector field $\vec{F}(x,y,z) = x^2y\,\hat{i} + 2y^3z\,\hat{j} + 3z\hat{k}$.

21. Evaluate $\int_C (xy + z^3)\,ds$ from (1, 0, 0) to (–1, 0, $\pi$) along the helix $C$ given by $x = \cos t$, $y = \sin t$, $z = t$ $(0 \le t \le \pi)$.

22. Show that the vector field $\vec{F}(x,y) = 2xy^3\,\hat{i} + (1+3x^2y^2)\,\hat{j}$ is a conservative field on the entire plane.

**(8 × 2 = 16 Marks)**

## SECTION – C

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

23. *Prove that $a \equiv b \pmod m$ if and only if $a$ and $b$ leave the same remainder when divided by $m$.*

24. Prove that no integer of the form $8n + 7$ can be expressed as a sum of three squares.

25. Using the Pollard rho method, factor the integer 8051.

26. If $p$ is a prime, then prove that $(p-1)! \equiv -1 \pmod p$.

27. Calculate $\iint_R \frac{\sin x}{x}\,dA$ where $R$ is the triangle in the $xy$-plane bounded by the $x$-axis, the line $y = x$, and the line $x = 1$.

28. Change the order of integration and hence evaluate $\int_0^2 \int_{x^2}^{2x} (4x + 2)\,dy\,dx$.

29. Evaluate $\iint_R \frac{x-y}{x+y}\,dA$ where $R$ is the region enclosed by the lines $x - y = 0$, $x - y = 1$, and $x + y = 3$.

30. Find the work done by the force field $\vec{F}(x,y,z) = xy\hat{i} + yz\hat{j} + xz\hat{k}$ on a particle that moves along the curve $C : \vec{r}(t) = t\hat{i} + t^2\hat{j} + t^3\hat{k}$ $(0 \le t \le 1)$.

31. Using Green's theorem, evaluate the integral $\oint_C (x^2 - y^2)\,dx + x\,dy$, where $C$ is the circle $x^2 + y^2 = 9$.

**(6 × 4 = 24 Marks)**

## SECTION – D

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

32. (a) Using Chinese Remainder theorem solve the linear system of congruence $x \equiv 3 \pmod 7$; $x \equiv 3 \pmod 5$ and $x \equiv 4 \pmod{12}$. **7**

(b) Find the primes $p$ for which $\dfrac{2^{p-1} - 1}{p}$ is a square. **8**

33. (a) Use a triple integral of find the volume of the solid within the cylinder $x^2 + y^2 = 9$ and between the planes $z = 1$ and $x + z = 5$. **7**

(b) Use spherical coordinates to find the volume of the solid that is within the sphere $x^2 + y^2 + z^2 = 9$, outside the cone $z = \sqrt{x^2 + y^2}$, and above the $xy$ – plane. **8**

34. Verify the divergence theorem for $\vec{F}(x,y,z) = 2x\hat{i} - yz\hat{j} + z^2\hat{k}$ where the surface $\sigma$ is the paraboloid $z = x^2 + y^2$ capped by the disk $x^2 + y^2 \le 1$ in the plane $z = 1$.

35. Verify Stoke's theorem for the vector field $\vec{F}(x,y,z) = (z - y)\hat{i} + (z + x)\hat{j} - (x + y)\hat{k}$, taking $\sigma$ to be the portion of the paraboloid $z = 9 - x^2 - y^2$ above the $xy$ – plane with upward orientation.

**(2 × 15 = 30 Marks)**

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