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Reg. No. | | | | | | | | |

IV Semester B.Sc. Degree Examination, September/October - 2022

KANNADA (Basic)

ಸಾಹಿತ್ಯ ಕೌಮುದಿ – 4

(Repeater)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

ಭಾಷೆ ಮತ್ತು ಬರಹದ ಶುದ್ಧಿಗೆ ಆದ್ಯತೆ ನೀಡಲಾಗುವುದು.

1. ಮೋಹಕ್ಕೆ ತುತ್ತಾದ ಮನುಷ್ಯ ಮಾನ–ಮರ್ಯಾದೆ ಲೆಕ್ಕಿಸಲಾರ–ಎಂಬ ಕವಿ ಜನ್ನನ ಹೇಳಿಕೆಯನ್ನು ನಿರೂಪಿಸಿರಿ. **(15)**

(ಅಥವಾ)

ಹುಬ್ಬಳ್ಳಿಯಾಂವಾ ಕವಿತೆಯನ್ನಾಧರಿಸಿ ಗಂಡು–ಹೆಣ್ಣಿನ ಪ್ರಣಯದ ನಿರ್ಮಲಭಾವ ಕುರಿತು ವಿವರಿಸಿರಿ.

2. ಯುದ್ಧದ ಭೀಕರತೆ ಪರಿಣಾಮಗಳನ್ನು ಕುರಿತು ಸಮಾಲೋಚಿಸಿರಿ. **(15)**

(ಅಥವಾ)

ಕುರುಕ್ಷೇತ್ರ ರಣರಂಗದಲ್ಲಿ ಸಂಜಯ ಕಣ್ ಬೆಳಕಾದ ಪ್ರಸಂಗವನ್ನು ಕುರಿತು ವಿವರಿಸಿರಿ.

3. ಬೇಕಾದ **ನಾಲ್ಕಕ್ಕೆ** ಟಿಪ್ಪಣಿ ಬರೆಯಿರಿ. **(4×5=20)**

I) ಯಶೋಧರರಾಜ.

II) ಮುಪ್ಪಿನ ಷಡಕ್ಷರಿ.

III) ವೈದೇಹಿ.

IV) ಕುಂತಿ.

V) ಕರ್ಣ.

VI) ಭೀಮನ ಅರ್ಭಟ.

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4. ಬೇಕಾದ **ಮೂರಕ್ಕೆ** ಸಂದರ್ಭದೊಡನೆ ಸ್ಪಷ್ಟೀಕರಿಸಿರಿ. (3×5=15)

I) ಬೆಗಡುಗೊಳ್ಳಲೇಕೆ ಮನವೇ ನರರ ಮಾಳ್ಕೆಯಿಂ.

II) ಇದ್ದೀತು ಘಂಠಿ ಪೆಪರ ಮೆಂಟೂ, ಕಂಫಿಟ್ಟೂ.

III) ಧರ್ಮವೂ ಅಸಮಾನತೆಯನ್ನು ಬೋಧಿಸುತ್ತದೆಯೇ

IV) ಇದೆ ಎನ್ನ ಧರ್ಮಕ್ಕೆ ಪ್ರತಿಫಲಂ!

V) ಓಹ್! ನಾನಿರುವುದು ಕರ್ನಾಟಕದಲ್ಲೇ.

5. ಒಂದೇ ವಾಕ್ಯದಲ್ಲಿ ಉತ್ತರಿಸಿರಿ. (15×1=15)

I) ಮುಪ್ಪಿನ ಷಡಕ್ಷರಿಯರ ಹುಟ್ಟೂರು ಯಾವುದು?

II) ಬೇಂದ್ರೆಯವರ ಪ್ರಥಮ ಕಾವ್ಯ ಸಂಕಲನ ಯಾವುದು?

III) ವೈದೇಹಿ ಅವರ ಮೊದಲ ಹೆಸರೇನು?

IV) ಯಾವ ವಿಶ್ವವಿದ್ಯಾಲಯದಿಂದ ಡಾ. ಗುರುದೇವಿ ಹುಲ್ಲೆಪ್ಪನವರ ಮಠರವರು ಎಂ.ಎ. ಪದವಿ ಪಡೆದಿರುತ್ತಾರೆ?

V) ಮಹಾತ್ಮಾ ಜ್ಯೋತಿಭಾ ಫುಲೆಯವರು ಎಷ್ಟನೇ ವಯಸ್ಸಿನಲ್ಲಿ ವಿವಾಹವಾದರು?

VI.) ಮಳೆಗಾಲದ ಕವಿಯೆಂದು ಯಾರನ್ನು ಕರೆಯುತ್ತಾರೆ?

VII) ಬದುಕಿನ ಮೂಲ ಯಾವುದು?

VIII) ಚೆನ್ನವೀರ ಕಣವಿಯವರ ತಂದೆ–ತಾಯಿಯ ಹೆಸರೇನು?

IX) ಕಾವ್ಯಾರ್ಥ ಚಿಂತನ ಕೃತಿಗೆ ಸಿಕ್ಕ ಪ್ರಶಸ್ತಿ ಯಾವುದು?

X) ಶ್ರೀ ಬಿ.ಎಸ್. ಪೋಳ್ ಅವರ ಕಾವ್ಯನಾಮ ಯಾವುದು?

XI) ಜ್ಯೋತಿರಾವರ ಮನೆತನದ ಮೂಲ ಉಪನಾಮ ಯಾವುದು?

XII) ಕುರುಕುಲ ಸಾರ್ವಭೌಮನ್ ಯಾರು?

XIII) ಧೃತರಾಷ್ಟ್ರನಿಗೆ ಕಣ್ಣಾಳಕರಾದವರಾರು?

XIV) ಕುವೆಂಪುರವರ ಆತ್ಮಚರಿತ್ರೆಯ ಹೆಸರೇನು?

XV) ಯುಗ ಯುಗಗಳಲ್ಲಿ ಯಾವ ಯುಗ ಶ್ರೇಷ್ಠ?

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Reg. No.

IV Semester B.Sc.(CBCS) Degree Examination, September/October - 2022

ENGLISH (AECC)

ENGLISH LANGUAGE SKILLS-II

(Regular)

Time : 3 Hours **Maximum Marks : 80**

I. i) a) Write a dialogue of enquiry between a customer and a shopkeeper on buying children's story Books' using primary and modal auxiliaries. (5)

b) Write a conversation between a station master and a passenger at the railway station about the arrival of 'chennai Express' using primary and modal auxiliaries. (5)

ii) a) Write a paragraph on how to get to 'Grand Hotel' from the railway station using a few of the prepositions given in the bracket.

(in the corner, near, next to, between, opposite to, behind beyond, along, past, across, down, up, towards) (5)

b) Write instructions to reach post office from bus stand using a few prepositions given in the bracket.(in the corner, near, next to, between, opposite to, behind, beyond, along, past, across, down, up, towards) (5)

II. i) a) Write instructions to your friend about the preparation of 'Lemon Juice' at home (5)

b) Write instructions to your team mates about the preparations for organizing 'Sports Day' in your college. (5)

ii) a) Write a formal telephone conversation between a student and a teacher about organizing a special lecture on 'Functional English in your college. (5)

b) Write an informal telephone conversation between two friends about visiting mysore zoo during the vacation. (5)

III. i) a) Interpret the given pie chart on the proportion of types of transportation used by students to go to their college. (5)

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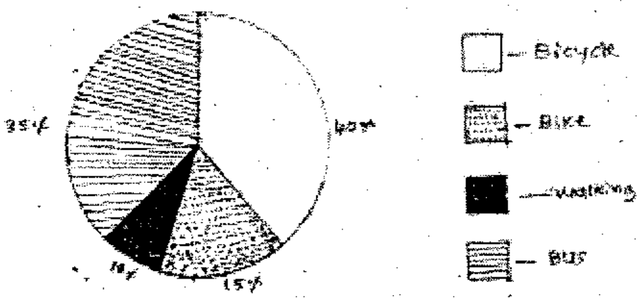
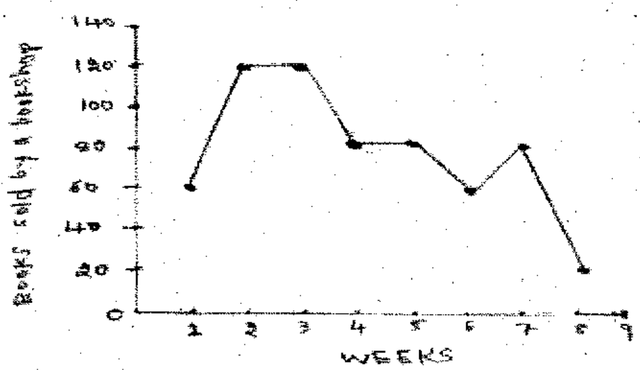
Types of Transportation to college



b) Interpret the following a line graph given on the number of books out by a bookshop each week during a certain period in one or two paragraphs. **(5)**



ii) a) Write a conversation for an appointment with a doctor/receptionist of a hospital for your treatment of severe flu. **(5)**

b) Write a conversation for an appointment with a bank manager for your educational loan. **(5)**

IV. i) a) Write a report of a Group Discussion conducted among five students on the topic of 'online learning-pros and cons. **(5)**

b) Write a short speech on 'Depletion of ozone Layer'. **(5)**

ii) a) Describe 'the bank manager of your locality using appropriate adjectives. **(5)**

b) Describe the botanical garden of your college. **(5)**

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Reg. No. [| | | | | | | |]

IV Semester B.Sc./B.C.A. Degree Examination, September/October - 2022

HINDI (MIL)

1) सपनों की होम डिलिवरी (उपन्यास) 2) पल्लवन 3) अनुवाद

(Regular)

Time : 3 Hours **Maximum Marks : 80**

I. किन्हीं दस प्रश्नों के उत्तर लिखिए : **(10×1=10)**

1) 'सपनों की होम डिलिवरी' किसकी रचना है?

a) मृदुला गर्ग b) ममता कालिया c) कृष्णा सोबती

2) ममता कालिया का जन्म कब हुआ?

a) सन् 1940 b) सन् 1941 c) सन् 1942

3) 'नरक-दर-नरक' किसकी रचना है?

a) कृष्णा सोबती b) ममता कालिया c) उषा प्रियंवदा

4) 'क' चैनल में रुचि का सहायक कौन था?

a) अकबर अली b) वीरेन्द्रसिंह c) कुर्बान अली

5) रुचि के मकान मालिक का नाम है-

a) शमशेर सिंह b) तेजिंदर सिंह c) वीरसिंह

6) रुचि और सर्वेश किस भाषा की फिल्म देखने गये थे?

a) चीनी b) फ्रांसीसी c) जापानी

7) रुचि के बेटे का नाम क्या है?

a) अमन b) गगन c) विराज

8) 'मनजीत' कहाँ रहती है?

a) अमृतसर b) मुंबई c) चेन्नई

9) दिव्यदर्शन पाठक किस संसदीय सीट से कोई चुनाव नहीं हारा था

a) काशी b) गया c) इलाहाबाद

[P.T.O.

10) रुचि शर्मा की लिखी किताबें कितनी भाषाओं में अनुवाद होकर छपती थी?

a) 6 b) 5 c) 4

11) रुचि ने सर्वेश को क्या नाम दिया?

a) पंद्रह अगस्त b) सोलह अगस्त c) सत्रह अगस्त

12) सी.सी.डी. का विस्तारित नाम क्या है?

a) कैफेडे b) कॉफी डे c) कैफे कॉफी डे

13) प्रभाकर शर्मा का पुरतैनी मकान कहाँ था?

a) अष्टम हाउसिंग सोसायटी b) नवम हाउसिंग सोसायटी c) सप्तम हाउसिंग सोसायटी

14) 'ऐसा कैसे हो सकता है। तुम मीडिया में हो वहाँ संवाद के बिना काम कैसे चल सकता है? किसका कथन है?

a) प्रभाकर b) रुचि c) सर्वेश

II. किन्ही दो का संदर्भ सहित अर्थ स्पष्ट कीजिए। **(2×7=14)**

1) 'नो मिस रुचि, हम कोई लफडा नहीं माँगते। आप उसको अपनी बात से कायल करो तभी जमेगा।'

2) 'घर में मैं कुकरी-शो नहीं चलाती, समझी।'

3) 'मजाक की भी हद होती है। इतने छोटे बच्चे को आप नशा करना सिखा रहे हैं।'

4) 'मैं सहजीवन को गलत रिवाज मानती हुँ। हमारे ऊपर समाज की जिम्मेदारी है।'

III. किसी एक प्रश्न का उत्तर लिखिए। **(1×14=14)**

1) 'सपनों की होम डिलिवरी' नए जमाने के करवट बदलते रिश्तों को केन्द्र में रखकर लिखा गया उपन्यास है। स्पष्ट कीजिए।

2) 'सपनों की होम डिलिवरी' उपन्यास का आशय स्पष्ट कीजिए।

IV. किन्हीं दो पात्रों का चरित्र चित्रण कीजिए। **(2×7=14)**

1) रुचि

2) सर्वेश

3) प्रभाकर

4) गगन

V. निम्नलिखित में से किन्हीं दो का भाव-पल्लवन कीजिए। **(2×9=18)**

1) जहाँ चाह वहाँ राह

2) मन के हारे हार है – मन के जीते जीत

3) चिंता चिता समान है

4) बुरी संगत से अकेला भला

VI. हिंन्दी में अनुवाद कीजिए। **(1×10=10)**

Travelling develops our knowledge. We can learn the good methods adopted by other people by seeing Them. All people can not go for travelling. But they can know about unknown places from the books written by travellers.

ಪ್ರವಾಸವು ನಮ್ಮ ಜ್ಞಾನವನ್ನು ಹೆಚ್ಚಿಸುತ್ತದೆ. ಬೇರೆ ಜನರು ಅನುಸರಿಸುವ ಒಳ್ಳೆಯ ವಿಧಾನಗಳನ್ನು ನೋಡಿ ಅವುಗಳನ್ನು ನಾವು ಕಲಿತುಕೊಳ್ಳಬಹುದು. ಎಲ್ಲಾ ಜನರಿಗೂ ಪ್ರವಾಸಕ್ಕೆ ಹೋಗುವುದು ಸಾಧ್ಯವಾಗಲಾರದು. ಆದರೆ ಅವರು ಅಪರಿಚಿತ ಸ್ಥಳಗಳ ಬಗೆಗೆ ಪ್ರವಾಸಿಗರು ಬರೆದ ಪುಸ್ತಕಗಳಿಂದ ತಿಳಿದುಕೊಳ್ಳಬಹುದು.

35434/42434/D340

Reg. No. [ ]

IV Semester B.Sc.3/B.Sc. 4 Degree Examination, September/October - 2022

MATHEMATICS(OPTIONAL)

PAPER : II GROUP THEORY FOURIER SERIES AND DIFFERENTIAL EQUATIONS

(Repeaters)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

1) Question paper contains three parts namely A,B,C
2) Answer all parts.

PART - A

Answer any **Ten** of the following **(10×2=20)**

1. a) Define Normal subgroup.

b) Define Kernal of homomorphism.

c) If $f : g \to g^1$ be a homomorphies then prove that $f(e) = e^1$ where e is identity of g.

d) Find Fourier constant a_0 for $f(x) = x^2$ in $(0, \pi)$.

e) Define periodic function give an example.

f) Find finite cosine transform of $f(x) = 1 + x$ in $(0,3)$

g) Define half - range sine and cosine series.

h) Solve $(D^2 + 5D + 6)y = 0$.

i) Find the particular Integral of $(D^2 + 2D + 1)y = e^{3x}$.

j) Solve $(D^3 - 8)y = 0$.

k) Solve $(x^2D^2 + xD - 9)y = 0$.

l) Prove that $x\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} + 2y = 0$ is exact.

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PART - B

Answer any **Four** questions, each question carries **Five** marks. **(4×5=20)**

2. If H is a normal subgroup of g, then prove that $xH.yH = xyH \forall x, y \in H$

3. Obtain fourier series of $f(x) = \frac{\pi - x}{2}$ in $0 < x < 2\pi$.

4. Find the half range sine and cosine series for the function $f(x) = 2x - 1$ in $(0,1)$.

5. With usual notation prove that $\frac{1}{f(D)} e^{ax} = \frac{1}{f(a)} e^{ax}$ if $f(a) \neq 0$.

6. Solve $(D^2 - 4D + 4)y = x^2$

7. Solve $x^2 \frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + 6y = \cos(2\log x)$.

PART - C

Answer any **Four** questions, each carries **Ten** marks. **(4×10=40)**

8. a) State and prove Fundamental theorem of Homomorphism.

   b) If $f : g \to g^1$ is homomorphism then prove that kerf is normal subgroup.

9. a) Obtain the fourier series for $f(x) = x^2$ in $(-\pi, \pi)$ and $f(x + 2\pi) = f(x)$ and hence prove that $\frac{\pi^2}{12} = 1 - \frac{1}{4} + \frac{1}{9} - \frac{1}{16} + - - - -$

   b) Find half range cosine series for the function $f(x) = (x-1)^2$ in $(0,1)$.

10. a) Find finite fourier sine transform of $f(x) = x^3$ in $(0, \pi)$.

    b) Find the finite cosine transform of $f(x) = e^{ax}$ in $(0, \pi)$.

11. a) With usual notation prove that $\frac{1}{f(D^2)} \cos ax = \frac{1}{f(-a^2)} \cos ax$ if $f(-a^2) \neq 0$.

    b) Solve $(D^2 - 3D + 2)y = e^x \cos 2x$

12. a) Find the condition for the equation $P_0\frac{d^3y}{dx^3}+P_1\frac{d^2y}{dx^2}+P_2\frac{dy}{dx}+P_3y=0$ to be exact.

b) Solve $\left(1+x^2\right)\frac{d^2y}{dx^2}+3x\frac{dy}{dx}+y=0$

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Reg. No. | | | | | | | | |

IV Semester B.Sc. (CBCS) Degree Examination, September/October - 2022

PHYSICS (OPTIONAL)

(Regular)

Time : 3 Hours **Maximum Marks : 80**

Instruction to Candidates.

1) **Calculators can be used to calculate Problems.**
2) **Write intermediate steps**
3) **Give physical meaning of symbols used.**

PART - I

1. Answer any TEN of the following questions. **(10×2=20)**

i. Define Enthalpy

ii. What is microcanonical ensemble

iii. What are bosons and fermions?

iv. What is seebeck effect?

v. What is temperature of inversion?

vi. Define Thomson co-effecient

vii. What is meant by division of wavefront

viii. Interference fringes formed on a screen 1m from double shit of width 0.5 mm are measured to be 1.2 mm apart. Find the wavelength of the light used.

ix. State the conditions of interference of light

x. State malus law of polarization

xi. The sodium doublet has wavelength 5890AU and 5896 AU. Calculate the resolving power of grating which can resolve these two lines

xii. Define specific rotation.

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PART - II

Answer Question number 2 or question number 3.

2. a) Derive maxwell's equations from thermodynamic potentials. (10)

   b) What are the limitations of Maxwell Boltzmann Statistics. (5)

3. a) Derive expression for Bose-Einstein distribution function. (10)

   b) Obtain Tds equations using maxwell's relations. (5)

PART - III

Answer Question number 4 or question number 5.

4. a) Derive the relation $\pi = T\frac{dE}{dT}$ and $(\sigma_A - \sigma_B) = -T\frac{d^2E}{dT^2}$ (10)

   b) The thermoelectric power of cadmium is $3\mu v/c^0$ at 0^0C and 15 $\mu v/c^0$ at 300^0C calculate the values of the constants 'a' and 'b'. (5)

5. a) What are thermoelectric diagrams? Find the peltier coefficient and Thomson's coefficient using thermoelectric diagram. (10)

   b) The emf of lead - iron thermocouple whose one junction is at 0^0C is given by E=1784 t - 2.4 t^2 in μv. when other junction temperature at 100^0C, Find the neutral temperatur e and peltier coefficient. (5)

PART - IV

Answer Question number 6 or question number 7.

6. a) Describe with necessary theory, the newton's ring experiment to determine the wavelength of monochromatic light (10)

   b) State and prove stokes law of reflection and transmission at interface. (5)

7. a) In case of thin film, derive the condition for maxima and minima due to interference of reflected light . (10)

   b) The diameter of the 10^{th} dark ring in newton's ring experiment of light of wavelength 5893 A^0U is 4mm. Calculate the thickness of air film at 10^{th} dark ring and radius of curvature of plano convex lens. (5)

PART - V

Answer Question number 8 or question number 9.

8. a) What is zone plate ? Describe the construction working and theory of zone plate. **(10)**

   b) A plane diffraction grating at a normal incidence gives a green line of wave lenth $\lambda_g = 5.4 \times 10^{-7} m$ in the nth order superimposed with violet line of wavelength $\lambda_g = 4.5 \times 10^{-7}$ m of (n+1)th order find the grating constant if the angle of diffraction is 30^0. **(5)**

9. a) Give the analytical treatment of production of circular and elliptically polarised light **(10)**

   b) Qwertz has refractive indices 1.553 and 1.544. Calculate the thickness of quarter wave plate for sodium light of wavelength 5890×10^{-10}m **(5)**

Reg. No. | | | | | | | | |

IV Semester B.Sc. 3 Degree Examination, September/October - 2022

PHYSICS (OPT)

(Non CBCS 2014-15)

(Old 2015-16 Onwards)

(Repeater)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

1. **Students can use calculators for solving problems**
2. **Write intermediate steps**

PART-A

Answer any Ten of the following. Each carries 2 marks. **(10×2=20)**

1. a) What is division of wavefront?

   b) Define resolving power of prism.

   c) What is double refraction

   d) Define specific rotation of a solution

   e) State stokes theorem in electromagnetic theory

   f) Define Thomson's coefficient

   g) Define dispersive power of grating

   h) Write two comparisons between zone plate and convex lens

   i) Write expression for velocity of light in vacuum according to electromagnetic theory

   j) The sodium doublet has wavelength 5890 A^0 and 5896 A^0, calculate the resolving power of grating which can resolve these two lines.

   k) In Newton's ring experiment the radius of the second dark ring is 0.07 cm. Find the radius of the 8^{th} dark ring.

   l) For a given thermocouple the temperature of cold junction is 10^0C and the neutral temperature is 300^0c. Calculate the temperature of inversion.

P.T.O.

PART - B

Answer any Four of the following. **(4×5=20)**

2. Derive an expression for the diameter of the bright rings in Newton's ring experiment.

3. Explain the construction of michelson Interferometer.

4. Distinguish between fresnel and fraunhoffer diffraction patterns.

5. The rotation in the plane of polarisation in a certain solution is 20^0/mm. Calculate the difference between the refractive index for right and left circularly polarised light. Given λ=589 nm

6. A series LCR circuit consist of an inductor 100 mH, capacitor 0.22 μF and resistor 1kΩ calculate resonant frequency & quality factor

7. The thermoelectric power of cadmium is 3μv/^{0}C at O^{0}C and 15 μv/^{0}C at 300^{0}C calculate the values of 'a' and 'b' constants.

PART - C

Answer any Four of the following . **(4×10=40)**

8. In case of thin films. Derive the conditions for maxima and minima due to interference of reflected light.

9. Define resolving power of diffraction grating Derive an expression for it

10. What tare thermoelectric diagrams? Find peltier coefficient and thomson's coefficient using thermoelectric diagrams.

11. Derive an expression for admittance in case of LCR parallel circuit. Mention the condition for resonance.

12. Derive expression for velocity of propagation of plane electromagnetic wave in free space.

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IV Semester B.Sc.5 (CBCS) Degree Examination, September/October - 2022

MATHEMATICS

Vector Calculus, Infinite Series & Differential Equations

(Regular)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

1. Question paper contains 3 parts namely A,B,C.
2. Answer all parts.

PART - A

1. Answer any **Ten** of the following (2 marks each) **(10×2=20)**

a) If $\vec{u} = t^2\hat{i} - t\hat{j} + (2t+1)\hat{k}$ & $\vec{v} = (2t-3)\hat{i} + \hat{j} - t\hat{k}$ find $\frac{d}{dt}(\vec{u}.\vec{v})$.

b) If $\vec{r} = (\cos nt)\hat{i} + (\sin nt)\hat{j}$, where 'n' is a constant & 't' varies show that $\vec{r} \times \frac{d\vec{r}}{dt} = n\hat{k}$.

c) Show that the vector $(x+3y)\hat{i} + (y-3x)\hat{j} + (x-2z)\hat{k}$ is solenoidal.

d) If a series $\sum u_n$ is convergent then $\lim_{n\to\infty} u_n = 0$

e) Test the convergence of $\sum \frac{1}{n^{1+\frac{1}{n}}}$

f) Define uniform convergence.

g) State Cauchy's general principle of convergence of series.

h) Test the convergence of $\sum \frac{x^n}{n^n}, (x > 0)$.

i) Find the complementary function of $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = e^{2x}$.

j) Solve ; $(D^2 + 36)y = \sin 2x$

P.T.O.

k) Solve; $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}-9y=0$

l) Prove that $(1+x^2)\frac{d^2y}{dx^2}+3x\frac{dy}{dx}+y=0$ is exact

PART - B

Answer any **Four** of the following (5 marks each) **(4×5=20)**

2. If $\vec{a}=(2x^2y-x^4)\hat{i}+(e^{xy}-y\sin x)\hat{j}+x^2\cos y\hat{k}$ verify that $\frac{\partial^2\vec{a}}{\partial y\partial x}=\frac{\partial^2\vec{a}}{\partial x\partial y}$.

3. If $\sum u_n$ & $\sum v_n$ are series of positive terms & $\sum v_n$ is Convergent and there is a positive constant 'K' such that $u_n \le kv_n \forall n > n$ then $\sum u_n$ is also convergent.

4. Discuss the convergence of $\sum\left(\frac{n+1}{n+2}\right)^n x^n$

5. Solve; $\frac{d^2y}{dx^2}-3\frac{dy}{dx}+2y=\sin^2 x$.

6. With usual notation prove that $\frac{1}{f(D)}xV = x.\frac{1}{f(D)}V-\frac{f'(D)}{[f(D)]^2}V$, where 'V' is a function of x.

7. Solve; $x^2\frac{d^2y}{dx^2}-3x\frac{dy}{dx}+5y=\sin(\log x)$.

PART - C

Answer any **Four** of the following (10 marks each) **(4×10=40)**

8. a) Show that the necessary & Sufficient condition for the vector $\vec{a}(t)$ to have a fixed direction is $\vec{a}\times\frac{d\vec{a}}{dt}=\vec{O}$

   b) Prove that $div\, curl\, \overline{F}=0$.

9. a) State & Prove Raabe's Test.

b) Discuss the convergence of $\frac{1^2.2^2}{1!}+\frac{2^2.3^2}{2!}+\frac{3^2.4^2}{3!}+\frac{4^2.5^2}{4!}+------$

10. a) State & Prove Leibnitz theorem for convergence of alternating series.

b) Define absolute convergence. Test the absolute convergence of $\sum_{n=1}^{\infty}(-1)^n \frac{n^{100}}{2n!}$

11. a) With usual notations, prove that $\frac{1}{f(D^2)}\sin ax = \frac{1}{f(-a^2)}\sin ax,\ f(-a^2)\neq 0$.

b) Solve ; $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+4y=e^{2x}.\cos x$

12. a) Find the condition that the equation

$P_0\frac{d^3y}{dx^3}+P_1\frac{d^2y}{dx^2}+P_2\frac{dy}{dx}+P_3y=0$ to be exact.

b) Solve; $x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}-3y=x^2\log x$

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IV Semester B.Sc.5 (CBCS) Degree Examination, September/October - 2022

MATHEMATICS

Vector Calculus, Infinite Series & Differential Equations

(Regular)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

1. Question paper contains 3 parts namely A,B,C.
2. Answer all parts.

PART - A

1. Answer any **Ten** of the following (2 marks each) **(10×2=20)**

a) If $\vec{u}=t^2\hat{i}-t\hat{j}+(2t+1)\hat{k}$ & $\vec{v}=(2t-3)\hat{i}+\hat{j}-t\hat{k}$ find $\frac{d}{dt}(\vec{u}.\vec{v})$.

b) If $\vec{r}=(\cos nt)\hat{i}+(\sin nt)\hat{j}$, where 'n' is a constant & 't' varies show that $\vec{r}\times\frac{d\vec{r}}{dt}=n\hat{k}$.

c) Show that the vector $(x+3y)\hat{i}+(y-3x)\hat{j}+(x-2z)\hat{k}$ is solenoidal.

d) If a series $\sum u_n$ is convergent then $\lim_{n\to\infty} u_n=0$

e) Test the convergence of $\sum\frac{1}{n^{1+\frac{1}{n}}}$

f) Define uniform convergence.

g) State Cauchy's general principle of convergence of series.

h) Test the convergence of $\sum\frac{x^n}{n^n},(x>0)$.

i) Find the complementary function of $\frac{d^2y}{dx^2}+5\frac{dy}{dx}+6y=e^{2x}$.

j) Solve ; $(D^2+36)y=\sin 2x$

P.T.O.

k) Solve; $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}-9y=0$

l) Prove that $(1+x^2)\frac{d^2y}{dx^2}+3x\frac{dy}{dx}+y=0$ is exact

PART - B

Answer any **Four** of the following (**5** marks each) **(4×5=20)**

2. If $\vec{a}=(2x^2y-x^4)\hat{i}+(e^{xy}-y\sin x)\hat{j}+x^2\cos y\hat{k}$ verify that $\frac{\partial^2\vec{a}}{\partial y\partial x}=\frac{\partial^2\vec{a}}{\partial x\partial y}$.

3. If $\sum u_n$ & $\sum v_n$ are series of positive terms & $\sum v_n$ is Convergent and there is a positive constant 'K' such that $u_n \le kv_n \forall n > n$ then $\sum u_n$ is also convergent.

4. Discuss the convergence of $\sum\left(\frac{n+1}{n+2}\right)^n x^n$

5. Solve; $\frac{d^2y}{dx^2}-3\frac{dy}{dx}+2y=\sin^2 x$.

6. With usual notation prove that $\frac{1}{f(D)}xV=x.\frac{1}{f(D)}V-\frac{f'(D)}{[f(D)]^2}V$, where 'V' is a function of x.

7. Solve ; $x^2\frac{d^2y}{dx^2}-3x\frac{dy}{dx}+5y=\sin(\log x)$.

PART - C

Answer any **Four** of the following (**10** marks each) **(4×10=40)**

8. a) Show that the necessary & Sufficient condition for the vector $\vec{a}(t)$ to have a fixed direction is $\vec{a}\times\frac{d\vec{a}}{dt}=\vec{O}$

b) Prove that $div\ curl\ \overline{F}=0$.

9. a) State & Prove Raabe's Test.

b) Discuss the convergence of $\frac{1^2.2^2}{1!}+\frac{2^2.3^2}{2!}+\frac{3^2.4^2}{3!}+\frac{4^2.5^2}{4!}+-----$

10. a) State & Prove Leibnitz theorem for convergence of alternating series.

b) Define absolute convergence. Test the absolute convergence of $\sum_{n=1}^{\infty}(-1)^n\frac{n^{100}}{2n!}$

11. a) With usual notations, prove that $\frac{1}{f\left(D^2\right)}\sin ax=\frac{1}{f\left(-a^2\right)}\sin ax,\ f\left(-a^2\right)\neq 0$.

b) Solve; $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+4y=e^{2x}.\cos x$

12. a) Find the condition that the equation

$$P_0\frac{d^3y}{dx^3}+P_1\frac{d^2y}{dx^2}+P_2\frac{dy}{dx}+P_3y=0 \text{ to be exact.}$$

b) Solve; $x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}-3y=x^2\log x$

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IV Semester B.Sc.3/B.Sc.4 Degree Examination, September/October - 2022

MATHEMATICS(OPTIONAL)

PAPER - I : VECTOR CALCULUS AND INFINITE SERIES

(Repeaters)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

1) Question paper contains three parts namely A,B,C
2) Answer all Parts.

PART - A

Answer any ten of the following (2 marks each). **(10×2=20)**

1. a) If, $\vec{A}=t^2\hat{i}-t\hat{j}+(2t+1)\hat{k}$ find $\left|\frac{d\vec{A}}{dt}\right|$.

b) If $\vec{r}=(\sinh t)\vec{a}+(\cosh t)\vec{b}$, where $\vec{a}\,\&\,\vec{b}$ are constant vectors, evaluate $\frac{d^2\vec{r}}{dt^2}$.

c) Find grad ϕ, where $\phi=3x^2y-y^3z^2 at (1,-2,-1)$.

d) If $\vec{f}=(xyz)\hat{i}+(3x^2y)\hat{j}+(xz^2-y^2z)\hat{k}$ then find $div\vec{f}$ at $(1,-1,1)$

e) Find the constant 'a' so that the vector function $\overline{A}=(x+3y)\hat{i}+(y-2z)\hat{j}+(x-az)\hat{k}$ is solenoidal

f) Define convergent series & Give an example.

g) Test the convergence of $\frac{1}{1.2}+\frac{1}{2.3}+\frac{1}{3.4}+---+\frac{1}{n(n+1)}$

h) Define conditional convergence of series & give an example.

i) State Cauchy's Root Test.

j) Test the convergence of $\frac{2!}{3}+\frac{3!}{3^2}+\frac{4!}{3^3}+----$

[P.T.O.

k) Let $\sum u_n$ & $\sum V_n$ be two series of positive terms such that $\sum V_n$ is convergent & $u_n \le K.v_n \forall n$ then prove that $\sum u_n$ is also convergent.

l) Test the convergence of $\sum \frac{1}{\sqrt{n}} \tan\frac{1}{n}$.

PART - B

Answer any **Four** questions, each question carries **Five** marks. **(4×5=20)**

2. If $\vec{r} = a\cos t\,\hat{i} + a\sin t.\hat{j} + at.\tan\alpha.\hat{k}$ find $\left|\frac{d\vec{r}}{dt} \times \frac{d^2\vec{r}}{dt^2}\right|$

3. If f & g are two scalar point functions then $\nabla(fg) = f\nabla g + g\nabla f$

4. Let $\sum u_n$ & $\sum v_n$ be two series of positive terms and $\lim_{n\to\infty}\frac{u_n}{v_n}$ be a finite non zero quantity. Then $\sum u_n$ & $\sum v_n$ both converge or diverge together.

5. Test the convergence of $1 + \frac{2!}{2^2} + \frac{3!}{3^2} + \frac{4!}{4^2} + ---$

6. State & Prove Leibnitz theorem for convergence of alternating series.

7. Discuss the convergence of $\sum\left(\frac{nx}{n+1}\right)^n$.

PART - C

Answer any **Four** questions, each carries **Ten** marks. **(4×10=40)**

8. a) If $\vec{A}(t), \vec{B}(t)$ & $\vec{C}(t)$ are differentiable vector functions of a scalar variable 't' then

$$\frac{d}{dt}\left(\vec{A}\times\left(\vec{B}\times\vec{C}\right)\right) = \frac{d\vec{A}}{dt}\times\left(\vec{B}\times\vec{C}\right) + \vec{A}\times\left[\frac{d\vec{B}}{dt}\times\vec{C}\right] + \vec{A}\times\left[\vec{B}\times\frac{d\vec{C}}{dt}\right]$$

b) If $\vec{a} = \left(2x^2y - x^4\right)\hat{i} + \left(e^{xy} - y\sin x\right)\hat{j} + x^2\cos y\hat{k}$ verify that $\frac{\partial^2\vec{a}}{\partial y\partial x} = \frac{\partial^2\vec{a}}{\partial x\partial y}$.

9. a) Define curl of a vector. Prove that curl $\left(\vec{A} + \vec{B}\right) = curl\vec{A} + curl\vec{B}$

b) If $\vec{f} = xy^2\hat{i} + 2x^2yz\,\hat{j} - 3yz^2\,\hat{k}$ find $div\,\vec{f}$ and $curl\vec{f}$

10. a) Prove that the series $\sum_{n=1}^{\infty}\frac{1}{n^p}$ is convergent if $p>1$ and is also divergent if $p\le 1$.

b) Discuss the convergence of the series $\sum_{n=1}^{\infty}\left[\sqrt{n^2+1}-\sqrt{n^2-1}\right]$.

11. a) State & Prove Raabe's Test

b) Discuss the convergence of $2-\frac{3}{2}+\frac{4}{3}-\frac{5}{4}+----$

12. a) State & Prove cauchys integral test .

b) Test the convergence of

$$\left(\frac{2^2}{1^2}-\frac{2}{1}\right)^{-1}+\left(\frac{3^3}{2^3}-\frac{3}{2}\right)^{-2}+\left(\frac{4^4}{3^4}-\frac{4}{3}\right)^{-3}+----$$

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Reg. No. [ ]

IV Semester B.Sc.5 Degree Examination, September/October - 2022

MATHEMATICS (SEC)

FOURIER TRANSFORMS

(Regular)

Time : 2 Hours **Maximum Marks : 40**

Instructions to Candidates :

1) Question paper containing two parts A and B.
2) Answer all parts.

PART - A

1. Answer any **Five** of the following. **(5×2=10)**

a) Define periodic function and give an example.

b) Find Fourier constant a_0 for $f(x)=x^2\ in\,(-\pi,\pi)$.

c) Define half-range sine and cosine series.

d) Write Fourier series of an even function $f(x)$ in $(-l,l)$.

e) Define finite cosine transform.

f) Find the finite Fourier sine transform of the function $f(x)=1\ in\,(0,\pi)$.

g) Find finite Fourier cosine transform of $f(x)=1+x$ in $(0,3)$.

PART - B

Answer any Six of the following: **(6×5=30)**

2. Obtain Fourier series for the function $f(x)=e^x\ in\,(-\pi,\pi)$.

3. Obtain Fourier series for the function $f(x)=\begin{cases}\pi+x, & if\quad -\pi<x<0\\ \pi-x & if\quad 0<x<\pi\end{cases}$

P.T.O.

4. Find the half range sine and cosine series for the function $f(x)=\pi-x$ in $(0,\pi)$.

5. Find half range cosine series for the function $f(x)=(x-1)^2$ in $(0,1)$. Hence deduce that

$$\frac{\pi^2}{8}=1+\frac{1}{3^2}+\frac{1}{5^2}+\ldots..$$

6. Find Fourier finite cosine transform of $f(x)=2-x$ in $(0,2)$.

7. Find the finite Fourier sine transform of $f(x)=x^3$ in $(0,\pi)$

8. Find the finite Fourier sine and cosine transformations of $f(x)=x$ in $(0,l)$

9. Find the finite Fourier sine transform of sinax in $(0,\pi)$.