Roll No. .... Total Pages : 3

011304

Mar. 2022

B.Tech. (AIML/CE/CSE/IT)-III SEMESTER

Maths-III (Calculus and Ordinary Differential Equations)

(BSC-301)

Time : 90 Minutes] [Max. Marks : 25

Instructions :

1. *It is compulsory to answer all the questions (1 mark each) of Part-A in short.*
2. *Answer any three questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART-A

1. (a) Define alternating series. (1)

(b) For which values of p, the series

$$1+\frac{1}{2^p}+\frac{1}{3^p}+\frac{1}{4^p}+\ldots\ldots \text{ converges?}$$ (1)

(c) Check if $f(x, y) = \tan^{-1}\left(\frac{y}{x}\right)$ is a homogeneous function or not. (1)

(d) What is saddle point? (1)

(e) Convert the spherical coordinates (4, 30°, 120°) to Cartesian coordinates. (1)

(f) Find the order and degree of the differential equation $y'' = (1 + y'^2)^{2/3}$. (1)

(g) What is Bernouli's equation? (1)

(h) Check if the differential equation $\frac{dy}{dx} = \frac{y \sin 2x}{y^2 + \cos^2 x}$ is exact or not. (1)

(i) Evaluate $\int_0^1 \int_0^2 \int_1^2 x^2 yz \, dx \, dy \, dz$. (1)

(j) Find the radius of convergence of the power series $\sum_{n=0}^{\infty} \frac{n!}{n^n} x^n$. (1)

PART-B

2. (a) Test the convergence of the sequence $\{a_n\}$, where $a_n = 2^n$. (2)

(b) Test the convergence of the series

$$\frac{1}{1.2.3} + \frac{3}{2.3.4} + \frac{5}{3.4.5} + \ldots.$$ (3)

3. (a) If $u(x, y) = x^y$, then find u_{xy}. (2)

(b) If $u = x^2 y^3$, $x = \log t$, $y = e^t$, then find $\frac{du}{dt}$. (3)

4. (a) Evaluate $\iint xy\,dx\,dy$ over the first quadrant of the circle $x^2 + y^2 = a^2$. (2)

(b) Evaluate $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y}\,dy\,dx$, after changing the order of integration. (3)

5. Verify Green's theorem for $\int_C (xy + y^2)\,dx + x^2\,dy$, where C is the boundary of the area between $y = x^2$ and $y = x$. (5)

6. (a) Solve $y\,dx - x\,dy + 3x^2y^2e^{x^3}\,dx = 0$. (2)

(b) Solve the differential equation $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 0$.

(3)

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301304

Dec., 2018

B.Tech. (CE/IT/CSE) IIIrd Semester

MATHEMATICS-III

(Calculus And Ordinary Differential Equations)

(BSC-301)

Time : 3 Hours] [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART–A

1. (a) Define Power series. Also explain the interval of convergence of power series. (1.5)

   (b) Using Taylor's series expansion, expand $\tan^{-1} x$ in powers of $(x - 1)$ upto four terms. (1.5)

   (c) Find the directional derivative of $f(x, y, z) = xy^2 + yz^3$ at the point $(2, -1, 1)$ in the direction of the vector $\hat{i} + 2\hat{j} + 2\hat{k}$. (1.5)

(d) Find div $\vec{f}$ and curl $\vec{f}$ if

$$\vec{f} = \text{grad}\,(x^3 + y^3 + z^3 - 3xyz).$$ (1.5)

(e) Evaluate the double integral,

$$\int_0^1 \int_x^{\sqrt{x}} (x^2 + y^2)\,dy\,dx.$$ (1.5)

(f) State Green's Theorem. (1.5)

(g) Solve the given linear differential equation :

$$\sin 2x \frac{dy}{dx} = y + \tan x.$$ (1.5)

(h) Solve $(px - y)(py + x) = a^2 p$. (1.5)

(i) Write the formula for Bessel's function of first kind of order n. (1.5)

(j) Solve the given Cauchy-Euler equation:

$$x^2 \frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = x^3.$$ (1.5)

PART–B

2. (a) Test the convergence of

$$1 + \frac{a}{b}x + \frac{a(a+1)}{b(b+1)}x^2 + \frac{a(a+1)(a+2)}{b(b+1)(b+2)}x^3 + \ldots\ldots\ldots\infty,$$

$(a,\ b > 0,\ x > 0)$. (8)

(b) Expand $\log(1 + x)$, $\log(1 - x)$ and $\log\sqrt{\frac{1+x}{1-x}}$. (7)

3. (a) Given $x + y + z = a$, find the maximum value of $x^m y^n z^p$. (8)

(b) Find the equation of tangent plane and normal to the surface $z^2 = 4(1 + x^2 + y^2)$ at $(2, 2, 6)$. (7)

4. (a) Evaluate the integral $\int_0^1 \int_x^{\sqrt{2-x^2}} \frac{x}{\sqrt{x^2+y^2}} dydx$ by changing the order of integration. (8)

(b) Using Stoke's theorem evaluate

$$\int_C [(x+y)dx+(2x-z)dy+(y+z)dz],$$

where C is the boundary of the triangle with vertices $(2, 0, 0)$, $(0, 3, 0)$ and $(0, 0, 6)$.

(7)

5. (a) Solve the given differential equation

$$\frac{dy}{dx}+y=xy^3.$$ (8)

(b) Solve the given equation, $p^2 + 2py \cot x = y^2$. (7)

6. (a) Solve the given equation using method of variation of parameters :

$$\frac{d^2y}{dx^2}-2\frac{dy}{dx}+y=e^x \log x.$$ (8)

(b) Find power series solution of the equation $\frac{d^2y}{dx^2}+x\frac{dy}{dx}+x^2y=0$ about $x = 0$. (7)

7. (a) Express the polynomial $x^3 + 2x^2 - x - 3$ in terms of Legendre's polynomials. (8)

(b) Express the vector field $2y\hat{i} - z\hat{j} + 3x\hat{k}$ in spherical polar coordinate system. (7)

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Roll No. ....

011304

December 2023

B. Tech (IT/CE (Hindi Medium)/CE/CSE/CSE (AIML)) – III SEMESTER

Mathematics III (Calculus and Ordinary Differential Equations)(BSC-301)

Time: 3 Hours **Max. Marks: 75**

Instructions:
1. *It is compulsory to answer all the questions (1.5 mark each) of Part -A in short.*
2. *Answer any four questions from Part -B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART –A

Q1 (a) Write the type of the sequence {-1, 1, -1, 1,...}. Is it convergent? (1.5)

(b) What is positive term series? (1.5)

(c) Test $\lim_{(x,y)\to(0,0)} \frac{2xy}{x^2+y^2}$ exists or not. (1.5)

(d) If $u = (x-y)(y-z)(z-x)$, then find $\frac{\partial u}{\partial y}$. (1.5)

(e) Evaluate $\int_0^1 \int_0^1 x\, e^y\, dy\, dx$. (1.5)

(f) State Green's theorem. (1.5)

(g) Find the integrating factor for the differential equation (1.5)

$$2\cos x \frac{dy}{dx} + 4\sin x\; y = 0$$

(h) Check if the following differential equation is exact: (1.5)

$$(y^2 + 2x^2y)dx + (2x^3 - xy)dy = 0$$

(i) What is Clairaut's type equation? Give an example. (1.5)

(j) Identify the nature of the singular points of the differential equation (1.5)
$x^2(x-2)y'' + (x-1)y' + 2xy = 0$

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PART -B

Q2 (a) Test the convergence of $\sum_{n=1}^{\infty}(\sqrt{n^4+1}-\sqrt{n^4-1})$ (8)

(b) Using Taylor's series expansion, prove that (7)

$$\log_e(1+e^x) = \log_e 2 + \frac{x}{2} + \frac{x^2}{8} - \frac{x^4}{192} + \cdots$$

Q3 (a) If $z = f(x,y)$ where $x = u^2 - v^2, y = 2uv$, prove that (8)

$$\frac{\partial^2 z}{\partial u^2} + \frac{\partial^2 z}{\partial v^2} = 4(u^2+v^2)\left(\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2}\right)$$

(b) Find the minimum value of the function $x^2+y^2+z^2$ subject to the condition $xy+yz+zx=3a^2$. (7)

Q4 (a) Using Gauss divergence theorem, evaluate $\iint_S \bar{F}.\bar{n}\, dS$ where $\bar{F} = 4xz\bar{\imath} - y^2\bar{\jmath} + yz\bar{k}$ and S is the surface of the cube bounded by the planes $x=0, x=2, y=0, y=2, z=0, z=2$. (8)

(b) Change the order of integration $\int_0^1\int_{x^2}^{2-x} xy\, dy\, dx$ and hence evaluate. (7)

Q5 (a) Solve the differential equation $p^2 - p(e^x + e^{-x}) + 1 = 0$ where p has usual meaning. (8)

(b) Solve $(2x+y+1)dy = (x+y+1)dx$. (7)

Q6 (a) Solve the following differential equation by using variation of parameter $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = \frac{e^{-x}}{x^2}$. (8)

(b) Find the power series solution of $(1-x^2)\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = 0$ in powers of x. (7)

Q7 (a) Solve $(D^4-1)y = e^x \cos x$. (8)

(b) Find the directional derivative of $2yz + z^2$ in the direction of the vector $\bar{\imath} + 2\bar{\jmath} + 2\bar{k}$ at the point (1, -1, 3). (7)

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301305

Dec. 2018

B.Tech. IIIrd Semester

EFFECTIVE TECHNICAL COMMUNICATION

(HSMC-01)

Time : 3 Hours] [Max. Marks : 75

Instructions :

(i) It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.

(ii) Answer any four questions from Part -B in detail.

(iii) Different sub-parts of a question are to be attempted adjacent to each other.

PART–A

1. Write short notes on :

(a) Argumentative discourse. (1.5)

(b) Rapid reading. (1.5)

(c) Ergonomics. (1.5)

(d) Localization. (1.5)

(e) Differentiate between public speech and group discussion. (1.5)

(f) Note taking. (1.5)

(g) Hypothesis. (1.5)

(h) What is etiquette? (1.5)

(i) The coach (agrees, agree) that I should practice more in the off-season. (1.5)

(j) Complete the sentence:
Sameer told me that ____________. (1.5)

PART–B

2. (a) Imagine that you are a consultant for admissions to engineering colleges. A prestigious engineering college is recently not getting sufficient admissions. The college wants to hire your services. Write a proposal detailing how you will increase admissions in the college. (10)

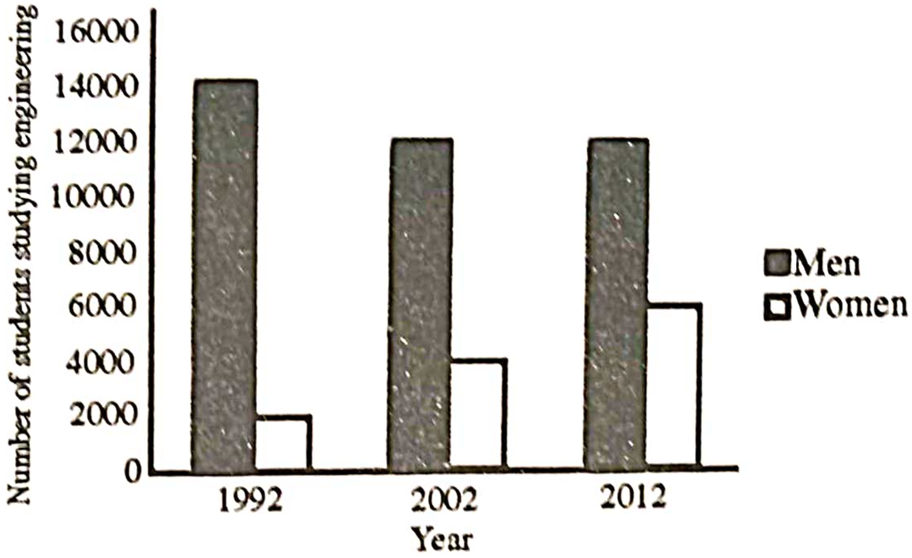
(b) Draft a memo for circulation to all the students of your university/college announcing anti-ragging campaign in order to ensure a safe environment. (5)

3. (a) List the points that should be borne in mind for using visual aids in an oral presentation. (5)

(b) The values we hold do not always align with our actions. Some values are difficult to live upto, or other priorities get in the way. Identify those values and present your arguments accordingly. (10)

4. What are the distinguishing features of written technical communication. How is it different from general writing? (15)

5. (a) The bar chart below shows the number of men and women studying engineering in Australian Universites. Summarise the information in the chart by selecting and reporting the main features. Make comparisions where relevant. (5)



(b) Discuss the format of a 'progress report' of a project. Mention its essential elements. (10)

6. (a) How should we deal with difficult callers in a telephonic conversation? (5)

(b) Compare life in today's technological age with life two centuries ago aided only by very simple technology. (250-300 words) (10)

7. Write a letter to the General Manager, Haryana Roadways, Gurugram asking him for starting a local bus from university to the city. (15)
