DEPT. OF MATHEMATICS

JHARGRAM RAJ COLLEGE

B.Sc(H) Sem – II , INTERNAL ASSESSMENT-1st , 2017-18

Sub: MATHEMATICS, Course – C4

Full Marks: 10 **Time: 30 m.**

Answer any five questions: $(\mathbf{2 \times 5 = 10})$

1. Show that the equation of the orthogonal trajectories of the system of curves $\frac{x^2}{a^2}+\frac{y^2}{a^2+\lambda}=1$, λ being a parameter, is $x^2+y^2+c=2a^2 logx$.
2. If y_1, y_2 are two independent solutions of a 2nd order linear differential equation with variable coefficients then write down the general solution of the said equation in terms of the given solutions.
3. Prove that $x=0$ is an Irregular Singular point of the following differential equation $x^3(x^2-1)\frac{d^2y}{dx^2}+2x^4\frac{dy}{dx}+4y=0$.
4. Find the Singular points of the differential equation $(x^2-4)\frac{d^2y}{dx^2}+3x\frac{dy}{dx}+3y=0$.
5. If $\vec{\alpha}=t^2\hat{\imath}-t\hat{\jmath}+(2t+1)\hat{k}$ and $\vec{\beta}=(2t-3)\hat{\imath}+\hat{\jmath}-t\hat{k}$, then find $\frac{d}{dt}\left(\vec{\alpha}\times\frac{d\vec{\beta}}{dt}\right)$ at t = 2.
6. Solve the System of equations $\frac{dx}{dt}-7x+y=0$, $\frac{dy}{dt}-2x-5y=0$.
7. If $\vec{a}=3p^2\hat{\imath}-(p+4)\hat{\jmath}+(p^2-2p)\hat{k}$ and $\vec{b}=\sin p\,\hat{\imath}+3e^{-p}\hat{\jmath}-3\cos p\,\hat{k}$ then Show that $\frac{d^2p}{dp^2}\left(\vec{a}\times\vec{b}\right)=-30\hat{\imath}+14\hat{\jmath}+20\hat{k}$ at $p=0$.

DEPT. OF MATHEMATICS
JHARGRAM RAJ COLLEGE
B.Sc(H) Sem – II , INTERNAL ASSESSMENT-2nd , 2017-18
Sub: MATHEMATICS, Course – C4

Full Marks: 10 **Time: 30 m.**

Answer any five questions: $(\mathbf{2} \times \mathbf{5} = \mathbf{10})$

1. Use the Method of undetermined coefficients to solve : $x^2 \frac{d^2y}{dx^2} - x\frac{dy}{dx} - 3y = x^2 \ln x$.
2. Show that $y_1(x) = e^{-\frac{x}{2}} \sin(\frac{x\sqrt{3}}{2})$ and $y_2(x) = e^{-\frac{x}{2}} \cos(\frac{x\sqrt{3}}{2})$ are linearly independent solutions of the differential equation $\frac{d^2y}{dx^2} + \frac{dy}{dx} + y = 0$.
3. Solve $\frac{dx}{xz} = \frac{dy}{yz} = \frac{dz}{xy}$.
4. Solve $\frac{dx}{x(y^2-z^2)} = \frac{dy}{y(z^2-x^2)} = \frac{dz}{z(x^2-y^2)}$.
5. Evaluate $\int_1^2 (\vec{r} \times \frac{d^2\vec{r}}{dt^2})dt$ where $\vec{r} = 2t^2\hat{\imath} + t\hat{\jmath} - 3t^2\hat{k}$.
6. Classify the fixed point for the system $\dot{X} = AX$ where $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$.
7. Find the eigen values of the system $\dot{x} = 4x - y$, $\dot{y} = 2x + y$.

DEPT. OF MATHEMATICS
JHARGRAM RAJ COLLEGE
B.Sc(H) Sem – II , INTERNAL ASSESSMENT-1st , 2018-19
Sub: MATHEMATICS, Course – C4

Full Marks: 10 **Time: 30 m.**
Answer any five questions: $(2 \times 5 = 10)$

1. Using Picard's method, find the third approximation of the solution of the equation – $\frac{dy}{dx} = x + y^2$, with $y(0) = 0$.
2. Prove that $y_1 = e^{2x}$ and $y_2 = e^{3x}$ are two independent solutions of the following differential equation – $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$.
3. Solve: $x\frac{d^2y}{dx^2} + (x-1)\frac{dy}{dx} - y = x^2$, by the method of operational factors.
4. Consider the linear autonomous system $\frac{dx}{dt} = -x$, $\frac{dy}{dt} = -2y$. Show that the critical point (0,0) is asymptotically stable.
5. Consider the linear autonomous system $\frac{dx}{dt} = 3x + 2y$, $\frac{dy}{dt} = x + 2y$. Determine the critical point of the system and determine the nature of the critical point.
6. Solve : $\frac{dx}{x(y^2-z^2)} = \frac{dy}{y(z^2-x^2)} = \frac{dz}{z(x^2-y^2)}$.
7. Solve : $\frac{dy}{dt} = y$ $\frac{dx}{dt} = 2y + x$.
8. Solve the equations $\frac{dx}{dt} = -wy$ and $\frac{dy}{dt} = wx$ and show that the point (x, y) lies on a circle.

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DEPT. OF MATHEMATICS
JHARGRAM RAJ COLLEGE
B.Sc(H) Sem – II , INTERNAL ASSESSMENT-1st , 2018-19
Sub: MATHEMATICS, Course – C4

Full Marks: 10 **Time: 30 m.**
Answer any five questions: $(2 \times 5 = 10)$

1. Using Picard's method, find the third approximation of the solution of the equation – $\frac{dy}{dx} = x + y^2$, with $y(0) = 0$.
2. Prove that $y_1 = e^{2x}$ and $y_2 = e^{3x}$ are two independent solutions of the following differential equation – $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$.
3. Solve: $x\frac{d^2y}{dx^2} + (x-1)\frac{dy}{dx} - y = x^2$, by the method of operational factors.
4. Consider the linear autonomous system $\frac{dx}{dt} = -x$, $\frac{dy}{dt} = -2y$. Show that the critical point (0,0) is asymptotically stable.
5. Consider the linear autonomous system $\frac{dx}{dt} = 3x + 2y$, $\frac{dy}{dt} = x + 2y$. Determine the critical point of the system and determine the nature of the critical point.
6. Solve : $\frac{dx}{x(y^2-z^2)} = \frac{dy}{y(z^2-x^2)} = \frac{dz}{z(x^2-y^2)}$.
7. Solve : $\frac{dy}{dt} = y$ $\frac{dx}{dt} = 2y + x$.
8. Solve the equations $\frac{dx}{dt} = -wy$ and $\frac{dy}{dt} = wx$ and show that the point (x, y) lies on a circle.

DEPT. OF MATHEMATICS
JHARGRAM RAJ COLLEGE
B.Sc(H) Sem – II , INTERNAL ASSESSMENT-2nd , 2018-19
Sub: MATHEMATICS, Course – C4

Full Marks: 10 **Time: 30 m.**
Answer any five questions: $(\mathbf{2 \times 5 = 10})$

1. Prove that $\sin x, \sin 2x, \sin 3x$ are linearly independent on $[0, 2\pi]$.
2. Linear combinations of solutions of an ordinary differential equation are solutions if the differential equation is
   (a) Linear non – Homogeneous
   (b) Linear Homogeneous
   (c) Non – Linear Homogeneous
   (d) Non – Linear non – Homogeneous
3. Prove that $x = 1$ is a regular Singular point of the following differential equation
   $x^3(x^2-1)\frac{d^2y}{dx^2} + 2x^4\frac{dy}{dx} + 4y = 0.$
4. Find the Singular points of the differential equation $(x^2-9)\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} + 3y = 0.$
5. Solve: $\frac{dx}{1} = \frac{dy}{2} = \frac{dz}{5z+\tan(y-2x)}$
6. Solve: $\frac{dx}{dt} = 4x - 2y$, $\frac{dy}{dt} = x + y.$
7. Solve: $\frac{dx}{y} = \frac{dy}{x} = \frac{dz}{z}$
8. Show that the points with position vectors $2\vec{\imath} - 3\vec{\jmath} + \vec{k}, 3\vec{\imath} + 2\vec{\jmath} - 5\vec{k}$, $\vec{\imath} + 4\vec{\jmath} + 7\vec{k}, 2\vec{\imath} + \vec{\jmath} + \vec{k}$ are coplanar.

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