Model Question Paper-2 with effect from 2019-20 (CBCS Scheme)

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18MATDIP31

Third Semester B.E.Degree Examination
Additional Mathematics-I
(Common to all Programmes)

Time: 3 Hrs Max.Marks: 100

Note: Answer any FIVE full questions, choosing at least ONE question from each module.

Module-I

1. (a) Show that $\left(\frac{1+\sin\theta+i\cos\theta}{1+\sin\theta-i\cos\theta}\right)^n=\cos\left(\frac{n\pi}{2}-n\theta\right)+i\sin\left(\frac{n\pi}{2}-n\theta\right)$. **(08 Marks)**

(b) Express $\sqrt{7}+9i$ in the polar form and hence find its modulus and amplitude. **(06 Marks)**

(c) Find the real part of $\frac{1}{1+\cos\theta+i\sin\theta}$ **(06 Marks)**

OR

2. (a) If $\vec{A}=\vec{i}+2\vec{j}+3\vec{k}$, $\vec{B}=-\vec{i}+2\vec{j}+\vec{k}$ and $\vec{C}=3\vec{i}+\vec{j}$, find p such that $\vec{A}+p\vec{B}$ is perpendicular to $\vec{C}$. **(08 Marks)**

(b) Find the area of the parallelogram whose adjacent sides are the vectors $\vec{A}=2\vec{i}+4\vec{j}-5\vec{k}$ and $\vec{B}=\vec{i}+2\vec{j}+3\vec{k}$. **(06 Marks)**

(c) If $\vec{A}=4\vec{i}+3\vec{j}+\vec{k}$ and $\vec{B}=2\vec{i}-\vec{j}+2\vec{k}$, find a unit vector N perpendicular to both $\vec{A}$ and $\vec{B}$ such that $\vec{A},\vec{B}$ and N form a right handed system. **(06 Marks)**

Module-II

3. (a) Obtain the Maclaurin's series expansion of $e^{m\cos^{-1}x}$ up to the terms containing x^5. **(08 Marks)**

(b) Prove that $xu_x+yu_y=3$,where $u=\log\left[\left(x^4+y^4\right)/\left(x+y\right)\right]$, using Euler's theorem, **(06 Marks)**

(c) If $u=f\left(x-y,y-z,z-x\right)$, show that $u_x+u_y+u_z=0$ **(06 Marks)**

OR

4. (a) Prove that $\log\left(\sec x+\tan x\right)=x+\frac{x^3}{6}+\frac{x^5}{24}+\ldots$, by using Maclaurin's series notion. **(08 Marks)**

(b) Using Euler's theorem, prove that $xu_x+yu_y=-2\cot u$,where $u=\cos^{-1}\left[\left(x^3+y^3\right)/\left(x+y\right)\right]$. **(06 Marks)**

(c) If $u=2xy, v=x^2-y^2$ & $x=r\cos\theta, y=r\sin\theta$, compute $\frac{\partial(u,v)}{\partial(r,\theta)}$. **(06 Marks)**

Module-III

5. (a) Aparticle moves on the curves $x=1-t^3, y=1+t^2, z=2t-5$ where t is the time variable. Determine the components of velocity and acceleration vectors at t = 1 in the direction of $\vec{i}+2\vec{j}+\vec{k}$. **(08 Marks)**

(b) Find the unit normal to the surface $xy^3z^2 = 4$ at $(1,-1,2)$ **(06 Marks)**

(c) Show that the vector field $\vec{F} = (x+y+z)\vec{i} + (x+2y-z)\vec{j} + (x-y+2z)\vec{k}$ is irrotational. **(06 Marks)**

OR

6. (a) Find $div\vec{F}$ and $curl\vec{F}$ where $\vec{F} = \nabla(x^3+y^3+z^3-3xyz)$ **(08 Marks)**

(b) If $\vec{F} = (3x^2y - z)i + (xz^3 + y^4)j - 2x^3z^2k$, find $grad(div\vec{F})$ at $(2,-1, 0)$ **(06 Marks)**

(c) Find the value of *'a'* such that vector field $\vec{F} = (x+3y)\vec{i} + (y-2z)\vec{j} + (x+az)\vec{k}$ is solenoidal. **(06 Marks)**

Module-IV

7. (a) Obtain a reduction formula for $\int_0^{\pi/2} \cos^n x dx$, $(n>0)$ **(08 Marks)**

(b) Evaluate: $\int_0^a \frac{x^2 dx}{(1+x^6)^{7/2}}$. **(06 Marks)**

(c) Evaluate $\iint_R (x^2+y^2) dxdy$, where R is the region bounded by $y = x$ & $y^2 = 4x$ **(06 Marks)**

OR

8. (a) Obtain a reduction formula for $\int_0^{\pi/2} \sin^n x dx, (n>0)$. **(08 Marks)**

(b) Evaluate : $\int_0^a x\sqrt{ax-x^2}\, dx$ **(06 Marks)**

(c) Evaluate: $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{dxdydz}{\sqrt{1-x^2-y^2-z^2}}$ **(06 Marks)**

Module-V

9. (a) Solve: $y(2x-y+1)dx + x(3x-4y+3)dy = 0$ **(08 Marks)**

(b) Solve: Solve: $\left[y^2e^{xy^2} + 4x^3\right]dx + \left[2xye^{xy^2} - 3y^2\right]dy = 0$ **(06 Marks)**

(c) Solve: $dx + \left(x - e^{-y}\sec^2 y\right)dy = 0$ **(06 Marks)**

OR

10. (a) Solve: $\tan y dy = (\cos y \cos^2 x - \tan x)dx$ **(08 Marks)**

(b) Solve: $[y(1+1/x) + \cos y]dx + [x + \log x - x\sin y]dy = 0$ **(06 Marks)**

(c) Solve: $(1+x^2)(dy - dx) = 2xydy$ **(06 Marks)**

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