Model Question Paper with effect from 2018-19

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17MAT31

Third Semester B.E.Degree Examination
Engineering Mathematics-III
(Common to all Branches)

Time: 3 Hrs Max.Marks: 100

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

Module-1

1. (a) Find the Fourier series expansion of $f(x)$, if $f(x)=\begin{cases}0, & in \quad -\pi \le x < 0 \\ \sin x, & in \quad 0 < x \le \pi.\end{cases}$

Hence deduce that $\frac{1}{1.3}-\frac{1}{3.5}+\frac{1}{5.7}-\ldots=\frac{(\pi-2)}{4}$ **(08 Marks)**

(b) Obtain the Fourier series of $f(x)=|x|$ valid in the interval $(-l,l)$. **(06 Marks)**

(c) Find the half-range cosine series of $f(x)=(x-1)^2$ the interval $0 \le x \le 1$. **(06 Marks)**

OR

2. (a) A periodic function $f(x)$ of period '6' specified by the following table over the interval $(0,6)$:

x	0	1	2	3	4	5	6
$f(x)$	9	18	24	28	26	20	9

Obtain the Fourier series up to second harmonics. **(08 Marks)**

(b) Obtain the Fourier series of $f(x)=x(2\pi-x)$ valid in the interval $(0,2\pi)$. **(06 Marks)**

(c) Find the half-range sine series of $f(x)=\begin{cases}\sin x & for \quad 0 \le x < \pi/4 \\ \cos x, & for \quad \pi/4 < x \le \pi/2\end{cases}$ **(06 Marks)**

Module-2

3. (a) If $f(x)=\begin{cases}1-x^2, & for \quad |x| \le 1 \\ 0 & for \quad |x|>1\end{cases}$, find the infinite Fourier transform of *f(x)* and hence evaluate

$\int_0^\infty \frac{x\cos x-\sin x}{x^3}\cos\frac{x}{2}\,dx$ **(08 Marks)**

(b) Find the Fourier sine transform of $\frac{1}{1+x^2}$ **(06 Marks)**

(c) Solve $u_{n+2}+6u_{n+1}+9u_n=2^n, u_0=0=u_1$, by using z-transforms. **(06 Marks)**

OR

4. (a) Find the Fourier sine transform of $e^{-|x|}$. Hence show that $\int_0^\infty \frac{x\sin mx}{1+x^2}dx = \frac{\pi e^{-m}}{2}, m. > 0.$ **(08 Marks)**

(b) Find the z-transform of $\cos[n\pi/2 + \pi/4]$ **(06 Marks)**

(c) Find the inverse z-transform of $18z^2/[(2z-1)(4z+1)]$ **(06 Marks)**

Module-3

5. (a) Define Karl Pearson's coefficient of correlation. If θ is the acute angle between the lines of regression, then show that $\tan\theta = \frac{\sigma_x\sigma_y}{\sigma_x^2+\sigma_y^2}\left(\frac{1-r^2}{r}\right)$. Explain the significance when $r=0 \,\&\, r=\pm 1$. **(08 Marks)**

(b) Fit a best fitting straight line $y = ax + b$ for the following data: **(06Marks)**

x	1	2	3	4	5
y	10	12	13	16	19

(c) Find the real root of the equation $2x - \log_{10} x = 7$, lying between $3.5 \,\&\, 4.0$ correct to three decimal places, using regula-falsi method. **(06Marks)**

OR

6. (a) Ten students got the following marks in Mathematics and Electronics in a class test:

Roll No.	1	2	3	4	5	6	7	8	9	10
Marks in Mathematics	78	36	98	25	75	82	90	62	65	39
Marks in Electronics	84	51	91	60	68	62	86	58	53	47

Calculate the coefficient of correlation. **(08 Marks)**

(b) Fit a best fitting parabola $y = ax^2 + bx + c$ for the following data: **(06 Marks)**

x	1	2	3	4	5	6	7	8	9
y	2	6	7	8	10	11	11	10	9

(c) Find a real root of the equation $3x - \cos x - 1 = 0$ correct to four decimal places, using Newton-Raphson method. **(06 Marks)**

Module-4

7. (a) Find the values y at (i) x=110 & (ii) x=390 using the following table gives the distance y (in nautical miles) of the visible horizon for the given heights x (in feet) above the earth's surface:

x	100	150	200	250	300	350	400
y	10.63	13.03	15.04	16.81	18.42	19.90	21.27

(08 Marks)

(b) Using Newton's general interpolation formula, construct an interpolating polynomial for the following data: **(06Marks)**

x	-3	0	1	3
$f(x)$	2	1	0	-1

(c) Using Weddle's rule, evaluate $\int_0^{\pi/2}\sqrt{\cos\theta}\,d\theta$, by dividing $[0,\pi/2]$ into six equal parts. **(06 Marks)**

OR

8. (a) Use an appropriate interpolation formula to find (i) y_{24} and (ii) y_{54}, given $y_{20}=612,\ y_{30}=539,\ y_{40}=446,\ y_{50}=343.$ **(08 Marks)**

(b) Using Lagrange's interpolation formula to fit a polynomial for the following data: **(06 Marks)**

x	0	1	3	4
y	-12	0	6	12

(c) Evaluate $\int_2^8 \frac{dx}{\log_{10} x}$, using Simpson's $(1/3)^{rd}$ rule taking 7 equidistant ordinates. **(06 Marks)**

Module-5

9. (a) Verify Green's theorem in the plane for $\oint_c (xy+y^2)dx + x^2 dy$ where C is the closed curve bounded by $y=x$ & $y=x^2$ **(08 Marks)**

(b) Using Stoke's theorem, evaluate $\iint_s (\nabla\times\vec{F})\cdot\hat{n}\,dS$ where $\vec{F}=3y\vec{i}-xz\vec{j}+yz^2\vec{k}$ and S is the surface of the paraboloid $2z=x^2+y^2$ bounded by $z=2$. **(06 Marks)**

(c) Prove that geodesics of a plane are straight lines. **(06 Marks)**

OR

10. (a) Using Gauss divergence theorem, evaluate $\iint_s (yz\hat{i}+zx\hat{j}+xy\hat{k})\cdot dS$ where S is the surface of the sphere $x^2+y^2+z^2=a^2$ in the first octant. **(08 Marks)**

(b) Derive Euler's equation in the standard form viz., $\frac{\partial f}{\partial y}-\frac{d}{dx}\left[\frac{\partial f}{\partial y'}\right]=0$ **(06 Marks)**

(c) Find the extremal of the functional $\int_0^{\pi}(y'^2-y^2+4y\cos x)dx$; $y(0)=0=y(\pi)$ **(06 Marks)**

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