

Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

2022 SCHEME

USN

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Course Code

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Fourth Semester B.E. Degree Examinations, July 2026

APPLIED MATHEMATICS FOR ELECTRICAL & ELECTRONICS ENGINEERING

Duration: 3 hrs

Max. Marks: 100

- Note:**
1. Answer any FIVE full questions, choosing ONE full question from each module.
 2. Use of Mathematics Formula Handbook is permitted.
 3. Missing data, if any, may be suitably assumed.

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO:PI)</u>
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Module-1

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|----|--|----|-------------|
| 1. | a. Fit a second degree parabola $y = ax^2 + bx + c$ in the least square sense for the following data and hence estimate y at $x = 6$. | 06 | (2:1:1.2.1) |
|----|--|----|-------------|

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

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|----|---|----|-------------|
| b. | Fit a least square geometric curve $y = ax^b$ for the following data. | 07 | (2:1:1.2.1) |
|----|---|----|-------------|

x	1	2	3	4	5
y	0.5	2	4.5	8	12.5

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|----|---|----|-------------|
| c. | A simply supported beam carries a concentrated load P at its mid-point. Corresponding to various value of P the maximum deflection Y is measured and is given in the following table. | 07 | (2:1:1.2.1) |
|----|---|----|-------------|

P	100	120	140	160	180	200
Y	0.45	0.55	0.60	0.70	0.80	0.85

Find a law of the form $Y = a + bP$ and hence estimate Y when P is 150.

(OR)

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|----|--|----|-------------|
| 2. | a. Obtain the lines of regression and hence find the coefficient of correlation for the data | 06 | (2:1:1.2.1) |
|----|--|----|-------------|

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

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|----|--------|----|-------------|
| b. | Given, | 07 | (2:1:1.2.1) |
|----|--------|----|-------------|

	x – series	y – series
Mean	18	100
SD	14	20

and $r = 0.8$, write down the equation of the lines of regression and hence find the most probable value of y when $x = 70$.

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|----|--|----|-------------|
| c. | Show that if θ is the angle between the lines of regression, then | 07 | (2:1:1.2.1) |
|----|--|----|-------------|

$$\tan \theta = \frac{\sigma_x \sigma_y}{\sigma_x^2 + \sigma_y^2} \left(\frac{1 - r^2}{r} \right)$$

Module-2

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|----|--------------------------------------|----|-------------|
| 3. | a. State and prove Euler's formulae. | 06 | (2:2:1.2.1) |
|----|--------------------------------------|----|-------------|

- b. Find the Fourier series in $(-\pi, \pi)$ to represent the function $f(x) = x - x^2$. 07 (2:2:1.2.1)

- c. Obtain the Fourier series of $f(x) = \frac{\pi - x}{2}$ in $0 < x < 2\pi$. 07 (2:2:1.2.1)

(OR)

4. a. Obtain the Sine half range Fourier series of $f(x) = x^2$ in $0 < x < \pi$. 06 (2:2:1.2.1)
- b. Obtain the cosine half range series for $f(x) = \pi - x$ in $0 < x < \pi$. 07 (2:2:1.2.1)
- c. Determine the constant term and the first cosine and sine terms of the Fourier series expansion of y from the following data. 07 (2:2:1.2.1)

x	0	45	90	135	180	225	270	315
y	2	3/2	1	1/2	0	1/2	1	3/2

Module-3

5. a. Find the Fourier Transform of $f(x) = \begin{cases} 1 - |x| & \text{for } |x| \leq 1 \\ 0 & \text{for } |x| > 1 \end{cases}$ and hence 06 (2:3:1.2.1)

deduce that $\int_0^\infty \frac{\sin^2 t}{t^2} dt = \frac{\pi}{2}$.

- b. Find the Fourier Sine and Cosine Transform of $f(x) = \begin{cases} x & 0 < x < 2 \\ 0 & \text{elsewhere} \end{cases}$ 07 (2:3:1.2.1)

- c. Find the Fourier Sine transform of $\frac{e^{-ax}}{x}$, $a > 0$. 07 (2:3:1.2.1)

(OR)

6. a. Find Discrete Time Fourier Transform (DTFT) of the signal $x(n) = a^n u(n)$ 06 (2:3:1.2.1)

- b. Find Discrete Time Fourier Transform of the signal $x(n) = \{1, 3, 5, 3, 1\}$ and evaluate $X(e^{j\Omega})$ at $\Omega = 0$. 07 (2:3:1.2.1)

- c. Find the Inverse Discrete Time Fourier Transform of $X(e^{j\Omega}) = 1$; $\frac{\pi}{2} < \Omega < \frac{\pi}{2}$ 07 (2:3:1.2.1)

Module-4

7. a. Obtain the Z-Transform of $\cos n\theta$ (2:4:1.2.1)

- b. Find the Inverse Z-Transform of $\frac{3z^2 + 2z}{(5z - 1)(5z + 2)}$ 07 (2:4:1.2.1)

- c. Solve the Difference equation $y_{n+2} + 6y_{n+1} + 9y_n = 2$ with $y_0 = y_1 = 0$ using Z-Transform. 07 (2:4:1.2.1)

(OR)

8. a. Determine the one sided or unilateral z-transform for the signal $x(n) = \{1, 2, 5, 7, 0, 1\}$ 06 (2:4:1.2.1)
 $\uparrow$
- b. Determine the unilateral z-transform for the sequence $x(n) = \{2, 4, 5, 7, 0, 1\}$ 07 (2:4:1.2.1)
 $\uparrow$
- c. Determine whether the following systems are casual and stable 07 (2:4:1.2.1)

$$H(z) = \frac{2z + 1}{z^2 + z - \frac{5}{16}}$$

Module-5

9. a. Determine a discrete-time LTI system characterized by impulse response $h(n) = (0.99)^n u(n+3)$ is (i) stable (ii) casual (iii) memoryless. 06 (2:5:1.2.1)
- b. A discrete-time LTI system has impulse response $h(n)$ as shown in Fig. Q9(b) using linearity and time invariance property determine the system output $y(n)$ if the input $x(n)$ is given by $x(n) = 2\delta(n) - \delta(n-1)$ 07 (2:5:1.2.1)

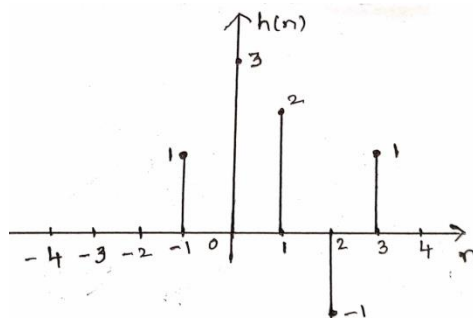


Fig. Q9(b)

- c. Evaluate the following continuous-time convolution integral 07 (2:5:1.2.1)
 $y(t) = u(t+1) * u(t-2)$
- (OR)
10. a. Find the natural response for the system described by the differential equation 06 (2:5:1.2.1)
 $5 \frac{dy(t)}{dt} + 10y(t) = x(t); y(0) = 3$
- b. Find the output of the system given by the difference equation 07 (2:5:1.2.1)
 $\frac{d^2 y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt}, y(0) = 0, \left. \frac{dy(t)}{dt} \right|_{t=0} = 1$ and $x(t) = 2e^{-2t}u(t)$.
- c. Find the response of the system described by the difference equation 07 (2:5:1.2.1)
 $y(n) - \frac{1}{9}y(n-2) = x(n-1)$ with $y(-1) = 1$ and $y(-2) = 0$ and $x(n) = u(n)$.

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