

Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT
 (Autonomous Institute under Visvesvaraya Technological University, Belagavi)

2022 SCHEME

USN

Course Code

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Fourth Semester B.E. Degree Examinations, July 2026
APPLIED MATHEMATICS FOR MECHANICAL 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. | Find the equation of the best fitting straight line $y = ax + b$ for the following data | 06 | (2:1:1.2.1) |
|----|----|---|----|-------------|

x	1	2	3	4	5
y	14	13	9	5	2

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|----|--|--|----|-------------|
| b. | | Fit a parabola $y = ax^2 + bx + c$ for the following data. | 07 | (2:1:1.2.1) |
|----|--|--|----|-------------|

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

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|----|--|---|----|-------------|
| c. | | 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

(OR)

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|----|----|--|----|-------------|
| 2. | a. | Find the correlation coefficient for the following two groups. | 06 | (2:1:1.2.1) |
|----|----|--|----|-------------|

A	92	89	87	86	83	77	71	63	53	50
B	86	83	91	77	68	85	52	82	37	57

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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. | | Ten students got the following percentage of marks in two subjects x and y . Compute their rank correlation coefficient | 07 | (2:1:1.2.1) |
|----|--|---|----|-------------|

Marks in x	78	36	98	25	75	82	90	62	65	39
Marks in y	84	51	91	60	68	62	86	58	53	47

Module-2

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|----|----|--|----|-------------|
| 3. | a. | Find the Laplace transform of the function $e^{-2t} \sinh 4t$ | 06 | (2:2:1.2.1) |
| | b. | Find the Laplace transform of the function $e^{-2t} (2 \cos 5t - \sin 5t)$ | 07 | (2:2:1.2.1) |
| | c. | Find the Laplace transform of the function $\frac{\cos at - \cos bt}{t}$ | 07 | (2:2:1.2.1) |

(OR)

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|----|----|--|----|-------------|
| 4. | a. | Find the Laplace transform of the full wave rectifier $f(t) = E \sin \omega t$, $0 < t < \frac{\pi}{\omega}$ having period $\frac{\pi}{\omega}$. | 06 | (2:2:1.2.1) |
|----|----|--|----|-------------|

- b. Find $L[f(t)]$ if $f(t) = \begin{cases} t & 0 \leq t \leq 1 \\ 2-t & 1 \leq t \leq 2 \end{cases}$ 07 (2:2:1.2.1)
- c. Express the function in terms of Heaviside unit step function and hence find their Laplace transform. 07 (2:2:1.2.1)

$$f(t) = \begin{cases} 1 & 0 < t \leq 1 \\ t & 1 < t \leq 2 \\ t^2 & t > 2 \end{cases}$$

Module-3

5. a. Find the inverse Laplace transform of the function 06 (2:3:1.2.1)
- $$\frac{1}{s+2} + \frac{3}{2s+5} + \frac{4}{3s-2}$$
- b. Find the inverse Laplace transform by completing the squares 07 (2:3:1.2.1)
- $$\frac{s+1}{s^2+s+1}$$
- c. Find the inverse Laplace transform by partial fraction method 07 (2:3:1.2.1)
- $$\frac{1}{s(s+1)(s+2)(s+3)}$$

(OR)

6. a. Using convolution theorem, obtain the inverse Laplace transform of the following functions. 06 (2:3:1.2.1)
- $$\frac{1}{(s-1)(s^2+1)}$$
- b. Solve by using Laplace transforms: $\frac{d^2y}{dt^2} + k^2y = 0$ given that $y(0) = 2$, $y'(0) = 0$. 07 (2:3:1.2.1)
- c. Solve $y'' - 2y' + y = e^{2t}$ subject to the conditions, $y(0) = 0$, $y'(0) = -1$ by using the Laplace transforms. 07 (2:3:1.2.1)

Module-4

7. a. Find the value of k such that the following distribution represents finite probability distribution. Hence find its mean and standard deviation. also find $P(x \leq 1)$, $P(x > 1)$, $P(-1 < x \leq 2)$ (2:4:1.2.1)
- | | | | | | | | |
|--------|-----|------|------|------|------|------|-----|
| x | -3 | -2 | -1 | 0 | 1 | 2 | 3 |
| $P(x)$ | k | $2k$ | $3k$ | $4k$ | $3k$ | $2k$ | k |
- b. Find the mean and standard deviation of Binomial distribution. 07 (2:4:1.2.1)
- c. The probability that a pen manufactured by a factory be defective is $\frac{1}{10}$. If 12 such pens are manufactured, what is the probability that (i) exactly 2 are defective (ii) atleast 2 are defective (iii) none of them are defective. 07 (2:4:1.2.1)

(OR)

8. a. The number of accidents in a year to taxi drivers in a city follows a Poisson distribution with mean 3. Out of 1000 taxi drivers find approximately the number of drivers with (i) no accidents in a year (ii) more than 3 accidents in a year. 06 (2:4:1.2.1)

- b. Find mean and standard deviation of Poisson distribution. 07 (2:4:1.2.1)
- c. In an examination 7% of students score less than 35% marks and 89% of students score less than 60% marks. Find the mean and standard deviation if the marks normally distributed. Given $P(1.2263) = 0.39$ and $P(1.4757) = 0.43$. 07 (2:4:1.2.1)

Module-5

9. a. Suppose X and Y are independent random variables with the following respective distribution, find the joint distribution of X and Y . Also verify that $COV(X, Y) = 0$ 06 (2:5:1.2.1)

x_i	1	2
$f(x_i)$	0.7	0.3

y_j	-2	5	8
$g(y_j)$	0.3	0.5	0.2

- b. The joint probability distribution table for two discrete random variables X and Y is given by $f(x, y) = k(2x + y)$ where x and y are the integers such that $0 \leq x \leq 2, 0 \leq y \leq 3$ 07 (2:5:1.2.1)
- (i) Find the value of the constant k
- (ii) Find the marginal probability distributions of X and Y
- c. Let X be a random variable with the following distribution and Y defined to be X^2 07 (2:5:1.2.1)

x_i	-2	-1	1	2
$f(x_i)$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$

Determine (i) the distribution g of Y (ii) the joint distribution of X and Y .

(OR)

10. a. Define (i) Null Hypothesis (ii) Type-I and Type-II error (iii) Significance level 06 (2:5:1.2.1)
- b. A survey was conducted in a slum locality of 2000 families by selecting a sample of size 800. It was revealed that 180 families were illiterates. Find the probable limits of the illiterate's families in the population of 2000. 07 (2:5:1.2.1)
- c. A group of 10 boys fed on a diet A and another group of 8 boys fed on a diet B for a period of 6 months recorded the following increase in weight (lbs). 07 (2:5:1.2.1)

diet A	:	5	6	8	1	12	4	3
diet B	:	2	3	6	8	10	1	2

Test whether diets A and B differ significantly regarding their effect on increase in weight. ($t_{0.05} = 2.12$ f or 16 d.f)

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