

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BVoc DEGREE EXAMINATION DECEMBER 2022
(Second Semester)

Branch – NETWORKING & MOBILE APPLICATION

MATHEMATICAL STRUCTURES

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(5 x 1 = 5)

- 1 Every square matrix satisfies its own _____.
 (i) Eigen values (ii) Characteristic equation
 (iii) determinant (iv) None of these
- 2 The interpolating function is also called as _____.
 (i) extrapolation (ii) interpolation
 (iii) smoothing junction (iv) polynomial interpolation
- 3 Simson's one third rule on numerical integration is called _____.
 (i) closed formula (ii) Simpsons' rule
 (iii) Romberg's formula (iv) Trapezoidal formula
- 4 In deriving the trapezoidal formula, we replace the arc of the curve $y=f(x)$ over each subinterval by its _____.
 (i) circle (ii) Chord
 (iii) parabola (iv) Trapezoid
- 5 The server utilization factor is also known as _____.
 (i) Clearing ratio (ii) utilization intensity
 (iii) traffic intensity (iv) busy period

SECTION - B (15 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks

(5 x 3 = 15)

- 6 a Find the eigen values of the matrix $A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 0 \\ 0 & 0 & 5 \end{bmatrix}$

OR

- b Find the rank of the matrix $A = \begin{bmatrix} 1 & 5 & 4 \\ 0 & 3 & 2 \\ 2 & 13 & 10 \end{bmatrix}$

- 7 a Using Newton's formula, find the value of $f(1.5)$ from the following data:

| | | | | | |
|-------|-------|-------|-------|-------|-------|
| X: | 0 | 1 | 2 | 3 | 4 |
| F(x): | 858.3 | 869.6 | 880.9 | 892.3 | 903.6 |

OR

- b A third degree polynomial passes through the points(0,-1), (1,1)(2,1) and (3,-2) find the polynomial.

- 8 a From the following table of values of x and y find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for $x = 1.05$.

| | | | | | | | |
|----|---------|---------|---------|---------|---------|---------|---------|
| X: | 1.00 | 1.05 | 1.10 | 1.15 | 1.20 | 1.25 | 1.30 |
| Y: | 1.00000 | 1.02470 | 1.04881 | 1.07238 | 1.09544 | 1.11803 | 1.14017 |

OR

Cont...

- b Divide the range into 10 equal parts, find the approximate value of $\int_0^{\lambda} \sin x dx$ by trapezoidal rule.

- 9 a Draw a network diagram for the following data

| | | | | | | | | | | |
|----------------------|------|---|---|---|---|-----|---|-----|---|-----|
| Activity: | A | B | C | D | E | F | G | H | I | J |
| Preceding activities | None | A | A | B | A | B,E | C | D,F | G | H,I |

OR

- b Find the critical path and find the total project duration for the following information.

| | | | | | | | | | | |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Activity: | 0-1 | 1-2 | 1-3 | 2-4 | 2-5 | 3-4 | 3-6 | 4-7 | 5-7 | 6-7 |
| Duration (in days) | 2 | 8 | 10 | 6 | 3 | 3 | 7 | 5 | 2 | 8 |

- 10 a A T.V repairman finds that the time spent on his jobs has an exponential distribution with mean 30 minutes. If he repairs sets in the order in which they came in and if the arrival of sets is approximately Poisson with an average rate of 10 per 8 hour day, what is repairman's expected idle time each day? How many jobs are ahead of the average set just brought in?

OR

- b Assume that the good trains are coming in a yard at the rate of 30 trains per day and suppose that the inter-arrival times follow an exponential distribution. The service time for each train is assumed to be exponential with an average of 36 minutes. If the yard can admit 9 trains at a time, calculate the probability that the yard is empty and find the average queue length?

SECTION -C (30 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 x 6 = 30)

- 11 a Find the eigen values and eigen vectors of the following matrix: $\begin{pmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ 7 & 2 & -3 \end{pmatrix}$

OR

- b Find the inverse of A using Cayley- Hamilton theory where $A = \begin{pmatrix} 7 & 2 & -2 \\ -6 & -1 & 2 \\ 6 & 2 & -1 \end{pmatrix}$.

- 12 a The following are data from the steady state table:

| | | | | | |
|-------------------------------|-------|-------|-------|-------|--------|
| Temperature °C | 140 | 150 | 160 | 170 | 180 |
| Pressure kg f/cm ² | 3.685 | 4.854 | 6.302 | 8.076 | 10.225 |

Using Newton's formula, find the pressure off the steady for a temperature of 142°.

OR

- b In the table below, estimate the missing value.

| | | | | | |
|----|---|---|---|---|----|
| X: | 0 | 1 | 2 | 3 | 4 |
| Y: | 1 | 2 | 4 | - | 16 |

Explain why it differs from $2^3=8$.

- 13 a Using the trapezoidal rule, evaluate $\int_{0.6}^2 y dx$ from the following table:

| | | | | | | | | |
|----|------|------|------|------|------|------|-------|-------|
| X: | 0.6 | 0.8 | 1.0 | 1.2 | 1.4 | 1.6 | 1.8 | 2.0 |
| Y: | 1.23 | 1.58 | 2.03 | 4.32 | 6.25 | 8.36 | 10.23 | 12.45 |

OR

- b Apply Simpson's rule to evaluate $\int_0^2 \frac{dx}{1+x^3}$ to two decimal places by dividing the range into 4 equal parts.

- 14 a A small project consist of seven activities for which the relevant data are given below.

| Activity | Preceding activities | Activity duration |
|----------|----------------------|-------------------|
| A | - | 4 |
| B | - | 7 |
| C | - | 6 |
| D | A, B | 5 |
| E | A, B | 7 |
| F | C, D, E | 6 |
| G | C, D, E | 5 |

1. Draw the network and find the project completion time.
2. Calculate the total float for each of the activities and highlight the critical path.
3. Draw the time scaled diagram.

OR

- b A Project consists of eight activities with the following relevant information:

| Activity | Immediate predecessor | Estimated durations(days) | | |
|----------|-----------------------|---------------------------|-------------|-------------|
| | | optimistic | Most likely | pessimistic |
| A | - | 1 | 1 | 7 |
| B | - | 1 | 4 | 7 |
| C | - | 2 | 2 | 8 |
| D | A | 1 | 1 | 1 |
| E | B | 2 | 5 | 14 |
| F | C | 2 | 5 | 8 |
| G | D, E | 3 | 6 | 15 |
| H | F, G | 1 | 2 | 3 |

- (i) Draw the PERT network and find the expected project completion time.
 - (ii) What duration will have 95% confidence for project completion?
 - (iii) If the average duration for activity F increases to 14 days, what will be its effect on the expected project completion time which will have 95% confidence?
- 15 a In a railway marshaling yard, good trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 36 minutes calculate the following :
- (i) the mean size
 - (ii) the probability that the queue exceeds 10.
- If the input of trains increases to an average 33 per day, what will be the change in (i) and (ii)?

OR

- b A super market has two girls serving at the counters. The customers arrive in a Poisson fashion of the rate of 12 per hour. The service time for each customer is exponential with mean 6 minutes. Find (i) the probability that an arriving customer has to wait for service (ii) the average number of customers (iii) the average time spent by a customer in the super market.

Z-Z-Z

END