

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BVoc DEGREE EXAMINATION MAY 2022
(Second Semester)

Branch – NETWORKING AND MOBILE APPLICATION

MATHEMATICAL STRUCTURES

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

One question from each unit (with four choices) (5 x 1 = 5)

- 1 A system of m linear equations in n unknowns is inconsistent if
(i) $r(A, B) \neq r(A)$ (ii) $r(A, B) = r(A) = n$
(iii) $r(A, B) = r(A) < n$ (iv) $r(A, B) < r(A)$
- 2 The difference of constant functions is
(i) 1 (ii) 0 (iii) $f(c) - f(0)$ (iv) $f(x+c) - f(c)$
- 3 Simpson's one third rule is also called _____ rule.
(i) circle (ii) rectangle (iii) parabolic (iv) elliptic
- 4 The total float of a critical activity is _____
(i) 1 (ii) 0 (iii) -1 (iv) 2
- 5 The server utilization factor $\rho =$
(i) μ/λ (ii) λ/μ (iii) $\lambda\mu$ (iv) $\mu - \lambda$

SECTION - B (15 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks

One question from each unit with either or type (5 x 3 = 15)

- 6 a Find the rank of the matrix $A = \begin{pmatrix} 1 & -2 & -1 \\ 2 & -4 & -2 \\ -1 & 2 & 1 \end{pmatrix}$

(OR)

- b Calculate A^4 when $A = \begin{pmatrix} -1 & 3 \\ -1 & 4 \end{pmatrix}$

- 7 a Prove that $\Delta(fi gi) = fi \Delta gi + gi+1 \Delta fi$

OR

- b Find the n^{th} difference of e^x .

- 8 a Find $\frac{dy}{dx}$ at $x=1$ from the following table:

x	1	2	3	4
y	1	8	27	64

OR

- b Evaluate $\int_{\frac{1}{2}}^1 \frac{1}{x} dx$, by Trapezoidal rule, by dividing the range into 4 equal parts.

- 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

Cont...

- b Construct the network diagram comprising activities B, C, ... Q and N such that the following constraints are satisfied:

$$B < E, F; C < G, L; E, G < H; L, H < I; L < M; H < N; H < J; I, J < P; P < Q$$

- 10 a Explain the operating characteristics of a Queueing system.

OR

- b A TV 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 come in, and if the arrival of sets is approximately Poisson with an average rate of 10 per 8-hour day, what is the repairman's expected idle time each day? How many jobs are ahead of the average set just brought-in?

SECTION -C (30 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

One question from each unit with either or type (5 x 6 = 30)

- 11 a Diagonalise the matrix $A = \begin{pmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{pmatrix}$

OR

- b Evaluate the matrix $A^6 - 25A^2 + 122A$, where A is $\begin{pmatrix} 0 & 0 & 2 \\ 2 & 1 & 0 \\ 1 & -1 & 3 \end{pmatrix}$

- 12 a Construct the Newton's forward interpolation polynomial for the following data:

X	4	6	8	10
Y	1	3	8	16

Use it to find the value of y for x=5.

OR

- b The following data gives the melting point of an alloy of lead and zinc, where t is the temperature in deg-C and p is the percentage of lead in the alloy.

p	40	50	60	70	80	90
t	184	204	226	250	276	304

Using Newton's interpolation formula, find the melting point of the alloy containing 84 percent of lead.

- 13 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

- b Dividing the range into 10 equal parts, find the approximate value of $\int_0^{\pi} \sin x \, dx$ by

(i) Trapezoidal rule

(ii) Simpson's rule.

- 14 a Distinguish between PERT and CPM.

OR

- b A project consists of a series of tasks labelled A, B, . . . H, I with the following relationship. Construct the network diagram having the following constraints:

$$A < D, E; B, D < F; C < G; B, G < H; F, G < I$$

Find also the minimum time of completion of the project, when the time (in days) of completion of each task is as following:

Task :	A	B	C	D	E	F	G	H	I
Time:	23	8	20	16	24	18	19	4	10

- 15 a A tax consulting firm has four service stations in its office to receive people who have problems and complaints about their income, wealth and sales taxes. Arrivals follow a Poisson distribution and on average 80 persons in an 8-hour in a service day. Each tax advisor spends an irregular amount of time servicing the arrival which have been found to have an exponential distribution. The average service time is 20 minutes. Calculate the average number of customers in the system, average number of customers waiting to be serviced, average time a customer spends in the system, and average waiting time for a customer. Calculate how many hours each week a tax advisor spends performing his job. What is the probability that a customer has to wait before he gets service? What is the expected number of idle tax advisors at any specific time ?

OR

- b A car servicing station has 3 stalls where service can be offered simultaneously. The cars wait in such a way that when a stall becomes vacant, the car at the head of the line pulls up to it. The station can accommodate at most four cars waiting at one time. The arrival pattern is Poisson with a mean of one car per minute during the peak hour. The service time is exponential with mean 6 minutes. Find the average number of cars in the service station during peak hours, the average waiting time and the average number of cars per hour that cannot enter the station because of full capacity.

Z-Z-Z

END