SECTION A: (40 MARKS)

Answer all *questions from this section.*

1. Two particles of mass A and B are connected by a light inextensible string passing over a smooth fixed pulley. Show that if A >B, the acceleration, a of the system is given by $\frac{g}{A+B}(A-B)ms^{-2}$ *(05 marks)*

2. Given that $P(A \cup B)= 0.8$, $P(A/B) = 0.2$ and $P(A^1 \cap B) = 0.4$, find:
   (i) $P(A \cap B)$
   (ii) $P(A)$ *(05 marks)*

3. The table below shows extracts of tangents of angles:

x^0	45.0	45.1	45.2	45.3
tan x	1.0000	1.0035	1.0070	1.0105

Using linear interpolation and extrapolation, find:

(i) $\tan^{-1}(1.0052)$ *(03 marks)*

(ii) tan (45.32). *(02 marks)*

4. Find the angle of projection of a ball which is thrown at $20ms^{-1}$, and is at its greatest height when it just passes over the top of a building that is 16m high. *(05 marks)*

5. Three machines A, B and C produce solar bulbs in the ratio 30%, 60% and 10%. Of those produced by machine A, 25% are colored, that of B is 30% and that of C is 70%. Find the probability that a bulb selected at random is;

(i) Colored. *(03 marks)*

(ii) Produced by C given that is not colored. *(02 marks)*

6. Using trapezium rule with five strips evaluate;

$\int_0^{\pi} \sqrt{sinx}\ dx$ correct to four decimal places. *(05 marks)*

7. The table below shows the concentration of roots of a certain tree with respect to depth

Root Concentration	80	75	86	60	75	92	86	50	64	75
Soil depth	62	58	60	45	68	68	81	48	50	70

Calculate the correlation coefficient between the root concentration and soil depth and comment. *(05 marks)*

8. The forces $\begin{pmatrix}0\\2\end{pmatrix}$, $\begin{pmatrix}0\\4\end{pmatrix}$, $\begin{pmatrix}0\\3\end{pmatrix}$ and $\begin{pmatrix}0\\a\end{pmatrix}N$ act at points $(p, 1)$, $(2,3)$, $(4,5)$ and $(6, 1)$ respectively. The resultant is $\begin{pmatrix}0\\3\end{pmatrix}N$ at point $(1, 1)$. Find the values of a and p. *(05 marks)*

Turn Over

SECTIONB (60 MARKS)

Answer any **five** *questions from this section .* **All** *questions carry equal marks.*

9. The probability density function $f(x)$is defined by;

$$f(x) = \begin{cases} c(x+3); & 0<x<2 \\ c(7-x); & 2<x<4 \\ 0; & x \text{ else where} \end{cases}$$

(i) Sketch the function $f(x)$ and hence use your sketch to find the value of c

(06 marks)

(ii) Determine the expectation, $E(x)$. *(03 marks)*

(iii) Find $P(1 \leq x < 3)$ *(03marks)*

10. The random variable X is distributed normally with mean μ and standard deviation σ such that

$P(X<35) = 0.2$ and $P(35<x<45) = 0.65$. Find;

(i) Values of μ and δ *(08 marks)*

(ii) $P(X>40)$ *(04 marks)*

11. A particle of mass 4kg starts from rest at a point $(2i - 3j + k)$ m. It is acted upon by a force $\mathbf{F} = (4i + 12t\,j - 3k)$ N. When a constant **F** acts on it, find the;

(a) Acceleration at any time ,t *(02 marks)*

(b) Velocity at any time, *t*. *(05 marks)*

(c) Work done by the force, F, after 2 seconds. *(05 marks)*

12. The frequency distribution below shows the ages of 240 students admitted to Makerere University.

Age (years)	18- < 19	19- < 20	20- < 24	24- < 26	26- < 30	30- < 32
Number of students	24	70	76	48	16	6

(a) Calculate the mean age of the students. *(06 marks)*

(b) (i) Draw a hisogram for the given data. *(04 marks)*

(ii) Use the histogram to estimate the modal age. *(02 marks)*

13. (a) The numbers $x = 4.8$, $y = 4.905$ and $z = 2$ are rounded off to the nearest number of decimal places. Find the range with in which the exact value of $\frac{z}{y-z}$ lies. *(05 marks)*

(b) Given that the numbers p and q are rounded off with errors e_p and e_q. Show that the maximum relative error in $\sqrt{pq}$ is given by $\frac{1}{2}\left(\left|\frac{e_p}{p}\right| + \left|\frac{e_q}{q}\right|\right)$ hence find the interval within which the exact value of $\sqrt{(1.20)\,(2.8)}$ is expected to lie. *(07 marks)*

14. A uniform ladder of weight W rests in limit equilibrium with its top end against a rough vertical wall and its lower end on a rough horizontal floor. If the coefficient of friction at the top and foot of the ladder are $^2/_3$ and $^1/_4$ respectively, find the angle which the ladder makes with the floor. Suppose that a man of weight 3W ascend the ladder above, find how far he can ascend before the ladder slips. *(12 marks)*

Turn Over

15. (a) Show that equation $x = cosx$ has a root between 0.2 and 1.5.

(03 marks)

(b) (i) Obtain the Newton's raphson formula for finding the root of the equation above. *(03 marks)*

(ii) Construct a flow chart;

- Reads the initial approximation x_o
- Computes and prints the root x_{n+1} correct to 3 *d.p.s.*

(iii) Perform a dry run for $x_o = 0.85$. *(06 marks)*

16. (a) A lorry covers distances of 25.6m and 32m in the fourth and eighth seconds of its motion respectively. Determine the initial speed of the lorry. *(06 marks)*

(b) Two points A and B are 526m apart along a straight road. A car moving along the road passes A with a constant speed of $25ms^{-1}$. The car maintains this speed for ten seconds and then decelerates uniformly to a speed V ms^{-1} for 8 seconds. The car maintains this speed until it passes point B. the total time taken by the car to move from point A to B is 30 seconds. Sketch a velocity-time graph for the motion of the car and use it to determine the value of V *(06 marks)*

END