Marks scored:

KATHMANDU UNIVERSITY
End Semester Examination
August/September, 2017

Level : B.Sc.
Year : II

Course : STAT 221
Semester: II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date SEP 10 2017

SECTION "A"
[10 Q. × 1 = 10 marks]

Fill in the blanks space(s) by most appropriate word(s) or symbol(s).

1. The data which have already been collected by someone are called _____
2. Additive model for time series Y=_____
3. In moving average method we cannot find trend values of some_____
4. A special type of bar chart that distributes the population by gender and age, and is generally used to illustrate the population structure of a society, is called a/an _____
5. The _____ is the average number of children born alive to any woman, assuming that she conforms to current fertility rates.
6. An index that is designed to measure changes in quantities over time is known as the _____
7. The order that runners cross the finish line is an example of_____scale.
8. How many scales of measurement exist?_____
9. Some hotels ask their guests to rate the hotel's services as excellent, very good, good, and poor. This is an example of the_____scale.
10. The lower control limit for p chart is given by _____

SECTION "B"
[10 Q. × 1 = 10 marks]

11. The first hand and unorganized form of data is called_____
    a. Secondary data b. Organized data c. Primary data d. Qualitative data
12. Census report used as a source of data is _____
    a. Secondary data b. Organized data c. Primary data d. None of the above
13. Prosperity, Recession and depression in a business is an example of_____
    a. Irregular Trend b. Cyclical Trend c. Seasonal Trend d. Qualitative data
14. Time series data have total number of components?
    a. 5 b. 3 c. 6 d. 4

15. The rise in prices before Dassein is an example of _____
a. Irregular Trend b. Cyclical Trend c. Seasonal Trend d. Qualitative data

16. The formula $\frac{\sum P_0 Q_n}{\sum P_0 Q_0} \times 100$_____
a. The Laspeyers quantity index number b. The Paasche's price index
c. The Laspeyers index d. The Paasche's quantity index

17. The formula $\frac{\sum P_n Q_n}{\sum P_0 Q_n} \times 100$_____
a. The Laspeyers quantity index number b. The Paasche's price index
c. The Laspeyers index d. The Paasche's quantity index

18. The number of live births per 1000 population in a given year_____
a. Crude birth rate b. Total fertility rate c. Morbidity rate d. Mortality rate

19. The number of deaths of infants under 1 year of age per 1,000 live births in a given year is termed the _____ rate.
a. Crude death b. Infant Mortality c. Growth d. Life expectancy

20. Which among the following is a type of control chart for variables?
a. C chart b. P chart c. $\bar{X}$ Chart d. U chart

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SECTION "C"
[3Q.× 7 = 21 marks]

1. The life tables is given below [2+1+1+2+1]

Age x	lx	Age x	lx	Age x	lx	Age x	lx
0	100000	20	99277	45	97817	70	85201
1	99562	25	99148	50	96923	75	77504
5	99484	30	98981	55	95510	80	65457
10	99440	35	98743	60	93393	85	48163
15	99387	40	98386	65	90159		

Find
a) ${}_{10}p_{50}$
b) What is the infant mortality per thousand in the table above?
c) What is under five mortality per thousand in the above table?
d) What is the probability of surviving between exact ages 30 and 40 in the table?
e) What is the probability of dying between exact ages 30 and 40 in the table?

OR

a. Suppose there are four items A, B, C and D passed by 90%, 80% 70% and 60%of individuals. Compare the differences in difficulty between A and B with the difference in difficulty with C and D.
b. Four items are to be constructed so that they are equally spaced on the difficulty scale. If the easiest item is passed by 80% of the group and most difficult item by 20%, find approximately the percentage of individuals in the group, passing other two items. [3.5+3.5]

2. Find the seasonal indices by the method of link relative method for the following data

	Quarters			
Year	I	II	III	IV
2000	16	13.5	14.7	17
2001	15.9	12.2	15.6	18
2002	16.3	10	15.9	19.9
2003	17.20	12.40	16.70	20.40

3. Find the trend values of the data given in question 2, de-seasonalize and interpret the data.

SECTION "D"

[3Q. × 3 = 9 marks]

4. What is the statistical set up of Nepal?

5. From the data given below, compute the following [1+2]
   i. The general fertility rate
   ii. The crude birth rate

   Assume that sex ratio at birth was 105 males to 100 females

Age Group	Female Population ('000)	Births
15 -19	513.2	24828
20 – 24	453.2	77448
25- 29	373.6	69111
30 – 34	341.5	35099
35 – 39	362	17322
40 -44	378.6	5110
45 – 49	346.0	378

6. What are σ scores and standard scores? In a distribution with mean 86 and σ = 15, Gopal's score is 91 and Rita's score is 83. Express these scores in standard scores in a distribution with mean 500 and σ = 100

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Semester: II
F. M. : 55

SECTION "B"

Attempt *ALL* questions. Assume any data if missing.

1. In the six-bar mechanism shown in Figure 1 below, $x_A = 0$, $y_A = 0$, $x_D = 450$ mm, $y_D = 0$, $l_{AB} = 150$ mm, $l_{BC} = 400$ mm, $l_{DC} = 350$ mm, $\angle CDE = 30^0$, $l_{DE} = 150$ mm, $l_{EF} = 350$ mm. The crank AB rotates at a constant speed of 10rad/s. First specify the type of two simple mechanisms used in Figure 1. Then find the total distance travelled by the slider F when the link AB rotates through 360^0. [Hint: Link CD and DE are welded] [1+1+4]

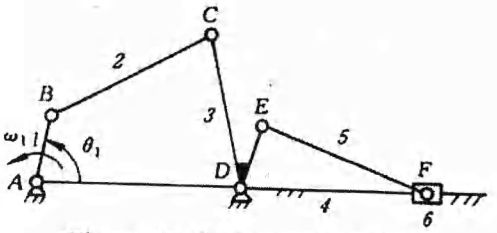

Figure 1: Six bar mechanism

2. As a student of theory of machines, you are asked to design a mechanical human arm using servo motors, joints, links and control system. State three specific design requirements for the mechanical human arm. Also, draw schematic drawing including joints and links that can mimic the motion of shoulder joint, elbow and wrist. Consider human body as a frame. [1.5+3.5]

3. Derive equations to describe the displacement diagram of a cam that rises with parabolic motion from a dwell to another dwell such that the total lift is L and the total cam rotation angle is β. Plot the displacement diagram and the first, second, and third-order kinematic coefficients, with respect to cam rotation. [8]

4. A pair of standard involute spur gears have a module of 5mm, pressure angle $\boldsymbol{\phi = 20^0}$, center distance a = 350 mm, transmission ratio $i_{12} = 9/5$. Calculate the numbers of teeth N_1, N_2, reference diameter d_1, d_2, addendum diameter d_{a1}, d_{a2}, base diameters d_{b1}, d_{b2}, tooth thickness s and space-width e. [2+1+1+1+1]

5. Two shafts A and B are co-axial. A gear C (50 teeth) is rigidly mounted on shaft A. A compound gear D-E gears with C and an internal gear G. D has 20 teeth and gears with C and E has 35 teeth and gears with an internal gear G. The gear G is fixed and is concentric with the shaft axis. The compound gear D-E is mounted on a pin which projects from an arm keyed to the shaft B. Sketch the arrangement and find the number of teeth on internal gear G assuming that all gears have the same module. If the shaft A rotates at 110 rpm, find the speed of shaft B. [4+6]

6. A shaft rotating at 200 rpm drives another shaft at 300 rpm and transmits 6 kW through a belt. The belt is 100 mm wide and 10 mm thick. The distance between the shafts is 4 m. The smaller pulley is 0.5 m in diameter. Calculate the stress in the belt if it is an open belt drive. [6]

7. Define the following terms [2×3 = 6]
   i. Free, Forced and Damped Vibration
   ii. Resonance

8. A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18 kg and 12.5 kg respectively, and each has an eccentricity of 60 mm. The masses at A and D have an eccentricity of 80 mm. The angle between the masses at B and C is 100^0 and that between the masses at B and A is 190^0, both being measured in the same direction. The axial distance between the planes A and B is 100 mm and that between B and C is 200 mm. If the shaft is in complete dynamic balance, determine:
   i. the magnitude of the masses at A and D
   ii. the distance between planes A and D; and
   iii. the angular position of the mass at D [8]