LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **STATISTICS**

FOURTH SEMESTER – **APRIL 2025**

PST4MC02 – BIOSTATISTICS AND SURVIVAL ANALYSIS

Date: 25-04-2025 Dept. No. Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

	SECTION A – K1 (CO1)	
	Answer ALL the questions	**(5 x 1 = 5)**
1	**Answer the following / Definitions:**	
a)	Define Biostatistics.	
b)	Define Specificity of a Diagnostic Test.	
c)	Write the survival function of Weibull distribution.	
d)	Give the Cox proportional hazards model.	
e)	What is the use of extended Cox model?	
	SECTION A – K2 (CO1)	
	Answer ALL the questions	**(5 x 1 = 5)**
2	**True or False/Fill in the blanks/MCQ**	
a)	Which of the following is an example of an observational study? a) Randomized controlled trial b) Cohort study c) Clinical trial with cross-over d) Meta-analysis	
b)	The formula for F1 Score is _____.	
c)	The Exponential distribution is used in survival analysis to model non-constant hazard rates.	
d)	The Cox Proportional Hazard model assumes that _____ remains constant over time.	
e)	The evaluation of the proportional hazard assumption can be done using both graphical and model-based approaches.	
	SECTION B – K3 (CO2)	
	Answer any THREE of the following	**(3 x 10 = 30)**
3	Explain Experimental studies with an example.	
4	A medical test was conducted on 120 individuals to diagnose a disease. The test results are summarized in the table below. Compute: (i) Sensitivity (ii) Specificity (iii) False Positive Rate (iv) False Negative Rate (v) Accuracy	

	Disease Present	**Disease Absent**
Positive Test Result	90	5
Negative Test Result	20	5

5	Explain Type I, Type II and Type III censoring.	
6	The survival distribution of a group of patients follows the exponential distribution with $G = 5$ (years) and $\lambda = 0.25$. Plot the survivorship function and find: (a) The mean survival time (b) The median survival time (c) The probability of surviving 6 years or more.	
7	Explain Stratified Cox model in detail.	

SECTION C – K4 (CO3)

Answer any TWO of the following **(2 x 12.5 = 25)**

8 Explain i) Case Control Study with the help of a diagram. (6)
ii) Clinical Trial with Independent concurrent control with a diagram. (6.5)

9 A study was conducted to determine the ability of Ultrasound(US) to diagnose appendicitis and the following table obtained for 283 children:

	Appendicitis	
	Present	Absent
US (+ve)	94	9
US (-ve)	15	165

Obtain i) Sensitivity ii) Specificity iii) Positive predictive value iv) Negative predictive value v) LR^+ and LR^- vi) Accuracy vii) F1 Score.

10 Derive S(t) and h(t) for Weibull and Gamma Distributions. Also derive the cumulative hazard function H(t) and establish its relationship with S(t).

11 Consider the following survival times of 16 patients in weeks: 4, 20, 22, 25, 38, 38, 40, 44, 56, 83, 89, 98, 110, 138, 145, and 27. (a) Does the exponential distribution provide a reasonable fit to the survival data? Use the probability plotting technique.
(b) Estimate graphically the parameter λ of the exponential distribution and consequently the mean survival time

SECTION D – K5 (CO4)

Answer any ONE of the following **(1 x 15 = 15)**

12 Explain Phase I, Phase II, Phase III and Phase IV Clinical Trials.

13 Actual condition (Gold Standard) and test score of a diagnostic test for 12 patients are given below. Draw the ROC curve and find the optimum cut value of the test.

Actual Condition	-	+	-	-	+	-	+	-	-	+	+	+
Test Score	18.5	22.3	24.7	26.1	28.4	30.2	31.2	33.8	35.5	37.6	40.2	42.9

SECTION E – K6 (CO5)

Answer any ONE of the following **(1 x 20 = 20)**

14 a) A group of young people using a specified drug and who had a stroke and also the people who are not affected is given below.

	Stroke	Control
Drug abuse	73	18
No drug abuse	141	196

Obtain
(i) Experimental event rate and Control event rate (ii) Relative risk (iii) Number need to treat
(iv) Relative risk reduction (v) Odds ratio (10)
b) Obtain the MLE of the parameters in a Weibull distribution assuming the data is Progressively censored. (10)

15 Obtain Kaplan-Meier Survival curves based on the data given below and provide your conclusion:
Treatment A:6, 6, 6, 7, 10, 13, 16, 22, 23, 6+ , 9+, 10+, 11+, 17+, 19+, 20+, 25+, 32+, 32+, 34+, 35+
Treatment B:1, 1, 2, 2, 3, 4, 4, 5, 5, 8, 8, 8, 8, 11, 11, 12, 12, 15, 17, 22, 23

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