LIAQUAT COLLEGE OF MEDICINE AND DENTISTRY
DEPARTMENT OF HEALTH PROFESSIONS EDUCATION
COLLEGE OF DENTISTRY

STUDY GUIDE – 2026

Third Year BDS

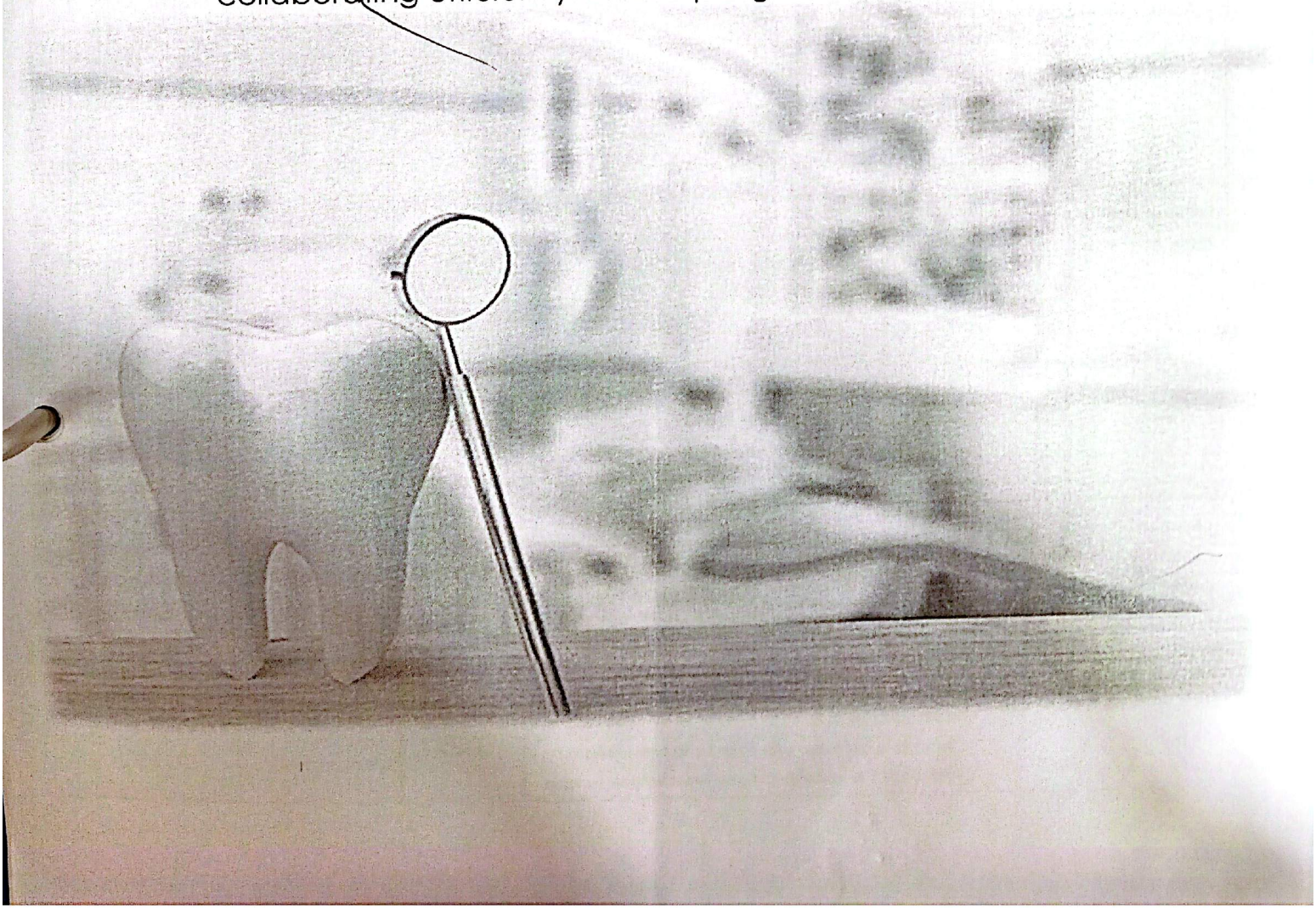
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Research				
Topic	Objectives	Mode of Teaching Lecture/ Tutorials	KSA Competencies Knowledge/ Skill/ Attitude	Assessment Tools
TERM I				
Hypothesis, errors, objective, inclusion exclusion criteria 1hr Samreen	1. Define, differentiate, and formulate null and alternative hypotheses. 2. Identify Type I and Type II errors, their impact, and ways to minimize them. 3. Develop clear, SMART research objectives aligned with the study. 4. Explain the significance, and establish appropriate inclusion and exclusion criteria for research studies.	Lectures, Workshops, Research meetings, small group discussions digital library sessions.	KSA	MCQs, Summative assignments research based.
Synopsis writing, filling IRB form 1hr Samreen	1. Describe the structure and key components of a research synopsis. 2. Develop a clear and concise synopsis following standard guidelines. 3. Identify the essential sections of an Institutional Review Board (IRB) form. 4. Accurately fill out an IRB form, ensuring ethical compliance in research. 5. Explain the purpose and importance of a consent form in research studies. 6. Draft a comprehensive consent form with clear participant information. 7. Define the function and significance of a Gantt chart in research planning. 8. Create a Gantt chart to effectively outline research timelines and milestones.			
Introduction of Hypothesis Testing 1hr Samreen	1. Interpret the results of hypothesis testing in a research context. 2. Apply hypothesis testing concepts to real-world dental research scenarios.			
Hypothesis Testing for One Sample Mean 1hr Dr Amna	1. Define hypothesis testing for one sample mean and its application in research. 2. Explain the assumptions required for conducting a one-sample mean test. 3. Differentiate between one-tailed and two-tailed tests. 4. Understand the use of z-test and t-test for one sample			

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	mean based on sample size and standard deviation availability. 5. Calculate test statistics and interpret p-values in decision-making.			
Non Parametric Alternative for One Sample Mean (Wilcoxon Sign Rank Test) **1 Hr** Dr. [illegible]	1. Define the Wilcoxon Signed-Rank Test and its application as a non-parametric alternative to the one-sample mean test. 2. Explain the assumptions and conditions for using the Wilcoxon Signed-Rank Test. 3. Differentiate between parametric (t-test) and non-parametric (Wilcoxon Signed-Rank Test) methods. 4. Perform the Wilcoxon Signed-Rank Test calculations and interpret the results. 5. Discuss the significance of using non-parametric tests in cases of non-normal data distribution.			
Hypothesis Testing for One Sample Proportion **1 Hr** Dr. Anna	1. Define hypothesis testing for one sample proportion and its application in research. 2. Explain the assumptions required for conducting a one-sample proportion test. 3. Differentiate between population proportion and sample proportion. 4. Calculate the test statistic (z-test) for one sample proportion. 5. Interpret the p-value and confidence intervals in decision-making.			
Hypothesis Testing for Means of 2 observations Paired Samples: Paired T Test **1 Hr** Dr. Anna	1. Define the Paired t-test and its application in hypothesis testing for two related observations. 2. Explain the assumptions required for conducting a Paired t-test. 3. Differentiate between paired and independent sample t-tests. 4. Calculate test statistics for paired samples and interpret the p-value. 5. Identify and minimize Type I and Type II errors in paired sample testing.			
Non Parametric Alternative for Means 2 Independent Samples: Mann Whitney U Test **1Hr** Dr. [illegible]	1. Define the Mann-Whitney U test as a non-parametric alternative to the independent t-test for comparing two independent samples. 2. Explain the assumptions and conditions for using the Mann-Whitney U test, including ordinal data or non-normally distributed interval/ratio data. 3. Describe the differences between parametric (independent t-test) and non-parametric (Mann-Whitney U test) approaches. 4. Perform calculations for the Mann-Whitney U test, including ranking the data and determining U values.			

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	5. Interpret the test results, including the U statistic, p-value, and decision regarding the null hypothesis. 6. Identify situations where the Mann-Whitney U test is more appropriate than a parametric test.			
	TERM 2			
Non Parametric Alternative for Paired T Test (Wilcoxon Sign Rank Test) 1 hr	1. Define the Wilcoxon Signed-Rank Test as a non-parametric alternative to the paired t-test for comparing two related samples. 2. Explain the assumptions and conditions for using the Wilcoxon Signed-Rank Test, including the use of ordinal data or non-normally distributed interval/ratio data. 3. Differentiate between the paired t-test and Wilcoxon Signed-Rank Test in terms of parametric vs. non-parametric approaches. 4. Define how to rank the differences between paired observations and calculate the test statistic. 5. Interpret the test results, including the significance of the p-value and the decision regarding the null hypothesis. 6. Recognize when to apply the Wilcoxon Signed-Rank Test over the paired t-test based on data distribution.			
Hypothesis Testing for Proportions of 2 observations Paired Samples 1hr	1. Define hypothesis testing for proportions in two related (paired) samples and its application in research. 2. Explain the assumptions required for testing proportions in paired samples, including the need for binary data. 3. Differentiate between paired sample t-tests and hypothesis tests for proportions in paired samples. 4. Calculate the test statistic (z-test for proportions) for paired observations. 5. Interpret the p-value and confidence intervals in decision-making for paired proportions.			
Hypothesis Testing for Means of > 2 observations Paired Samples: Repeated Measures ANOVA 1 hr	1. Define Repeated Measures ANOVA and its application in hypothesis testing for means of more than two related (paired) observations. 2. Explain the assumptions required for conducting Repeated Measures ANOVA, including normality, sphericity, and the dependence of observations. 3. Differentiate between Repeated Measures ANOVA and one-way ANOVA for independent samples. 4. Define the F-statistic in Repeated Measures ANOVA and how to interpret p-values to assess differences among means. 5. Identify and minimize Type I and Type II errors in Repeated Measures ANOVA. 6. Perform post-hoc tests (if necessary) to explore significant differences between groups.			

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Non Parametric Alternative for Repeated Measures ANOVA (Friedman Test)	1. Define the Friedman test as a non-parametric alternative to Repeated Measures ANOVA for comparing more than two related (paired) observations. 2. Explain the assumptions and conditions for using the Friedman test, including ordinal data or non-normally distributed interval/ratio data. 3. Differentiate between Repeated Measures ANOVA and the Friedman test in terms of parametric vs. non-parametric approaches. 4. Describe the procedure for conducting the Friedman test, including ranking the data and calculating the test statistic. 5. Interpret the results, including the p-value and decision regarding the null hypothesis.			
Hypothesis Testing for Proportions of > 2 observations Paired Samples: Cochrane Q Test 1 hr	1. Define the Cochran's Q test and its application in hypothesis testing for proportions of more than two related (paired) observations. 2. Explain the assumptions required for using the Cochran's Q test, including binary (dichotomous) data and dependent samples. 3. Differentiate between Cochran's Q test and other tests for proportions, such as the Chi-square test, in terms of paired versus independent samples. 4. Calculate the Cochran's Q statistic and interpret the results, including the p-value. 5. Describe how to apply post-hoc tests if Cochran's Q test indicates significant differences. 6. Identify when the Cochran's Q test is more appropriate than other tests for comparing proportions in repeated measures data.			
Hypothesis Testing for Means of 2 Independent Samples: Independent T Test 1 hr	1. Define the Independent t-test and its application in hypothesis testing for means of two independent samples. 2. Explain the assumptions required for conducting an Independent t-test, including normality and equal variances between the groups. 3. Differentiate between paired and independent samples in the context of hypothesis testing. 4. Calculate the test statistic (t-value) for independent samples and interpret the p-value. 5. Describe the concept of degrees of freedom and its role in the t-distribution.			
Non Parametric Alternative for Means 2 Independent	1. Define the Mann-Whitney U test as a non-parametric alternative to the Independent t-test for comparing two independent samples. 2. Explain the assumptions and conditions for using the			

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Samples: Mann Whitney U Test **1 Hr**	Mann-Whitney U test, including ordinal data or non-normally distributed interval/ratio data. 3. Differentiate between parametric (Independent t-test) and non-parametric (Mann-Whitney U test) methods. 4. Define the procedure for performing the Mann-Whitney U test, including ranking the data and calculating the U statistic. 5. Interpret the test results, including the p-value and decision regarding the null hypothesis.			
TERM 3				
Hypothesis Testing for Proportions of Independent Samples: Chi-Square Test **1 hr**	1. Define the Chi-Square test and its application in hypothesis testing for proportions of independent samples. 2. Explain the assumptions required for conducting the Chi-Square test, including categorical data and independence of observations. 3. Differentiate between the Chi-Square test for goodness of fit and the Chi-Square test for independence. 4. Calculate the Chi-Square statistic and interpret the results, including the p-value and degrees of freedom. 5. Define how to check for expected cell counts to ensure the validity of the test			
Hypothesis Testing for Means of >2 Independent Samples: One Way ANOVA **1 hr**	1. Define One-Way ANOVA and its application in hypothesis testing for means of more than two independent samples. 2. Explain the assumptions required for conducting One-Way ANOVA, including normality, homogeneity of variances, and independence of samples. 3. Differentiate between One-Way ANOVA and the Independent t-test in terms of the number of groups compared. 4. Calculate the F-statistic and interpret the p-value to determine if there are significant differences between the group means. 5. Describe the concept of between-group and within-group variability. 6. Conduct post-hoc tests (such as Tukey's HSD) if One-Way ANOVA shows significant differences to identify which groups differ.			
Parametric Alternative for Means of >2 Independent Samples: Kruskal Wallis Test	1. Define the Kruskal-Wallis test as a non-parametric alternative to One-Way ANOVA for comparing the means of more than two independent samples. 2. Explain the assumptions and conditions for using the Kruskal-Wallis test, including ordinal data or non-normally distributed interval/ratio data.			

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1 hr	3. Differentiate between parametric (One-Way ANOVA) and non-parametric (Kruskal-Wallis test) approaches. 4. Describe the procedure for performing the Kruskal-Wallis test, including ranking the data and calculating the test statistic (H). 5. Interpret the test results, including the p-value and decision regarding the null hypothesis.			
Linear regression **1Hr**	1. Define the concept of linear regression and its use in predicting the relationship between dependent and independent variables. 2. Identify and explain the assumptions of linear regression, including linearity, normality, independence, and homoscedasticity. 3. Differentiate between simple and multiple linear regression models based on the number of independent variables. 4. Learn how to calculate and interpret the regression coefficients (slope and intercept) in a linear regression model. 5. Interpret the R-squared value to assess how well the model fits the data. 6. Describe how to evaluate the significance of the regression model using p-values and F-tests.			
Logistic Regression **1 Hr**	1. Define logistic regression for predicting binary outcomes (e.g., success/failure). 2. Differentiate between linear and logistic regression for binary outcomes. 3. Interpret logistic regression coefficients, including odds ratios. 4. Know the assumptions of logistic regression, like independence and log-odds linearity. 5. Assess model significance using p-values, confidence intervals, and likelihood ratio tests. 6. Evaluate model fit with metrics such as AIC and pseudo R-squared. 7. To evaluate performance by useing confusion matrices, sensitivity, specificity, and ROC curves			
Developing tables **1 Hr**	1. Describe the importance of tables in presenting research clearly. 2. Organize data effectively and use the appropriate table types. 3. Format tables for clarity, following research guidelines. 4. Summarize statistical results in tables and ensure consistency. 5. Interpret and explain table data accurately in research papers.			

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	6. Apply best practices for presenting results in dental research.			
Writing results, Limitations and discussion **1 Hr**	1. Present research results clearly with statistical analyses and visuals. 2. Write the results section focusing on key findings without interpretation. 3. Discuss study limitations constructively. 4. Interpret findings in relation to existing literature in the discussion. 5. Suggest future research directions based on findings and limitations. 6. Describe the role of results, limitations, and discussion in enhancing research clarity.			
	TERM IV			
Threats to Validity **1 Hr**	1. Identify and understand threats to internal, external, construct, and statistical conclusion validity. 2. Recognize biases and errors that affect research accuracy. 3. Learn strategies to control confounding variables, ensure generalizability, and improve measurement tools. 4. Apply methods to minimize threats to validity in dental research design and analysis.			
Critical analysis of a Research paper: Checklist **1hr**	1. Describe the key components of a research paper and evaluate their clarity and relevance. 2. Assess the study design, sample size, and methodology for rigor and appropriateness. 3. Critically analyze data collection methods, statistical analyses, and ethical considerations. 4. Evaluate the interpretation of results, study limitations, and biases. 5. Use a checklist to systematically and objectively critique research papers.			
Clinical Trials And Good Clinical Practices Guidelines **1 hr**	1. Explain clinical trials, their purpose, and ethical considerations. 2. Learn Good Clinical Practice (GCP) guidelines and regulatory requirements. 3. Describe the process of designing, conducting, and reporting clinical trials. 4. Identify risks and biases in clinical trial design and implementation.			
Systematic Review **1 hr**	1. Define the purpose and steps of conducting a systematic review, including formulating questions, searching, and selecting studies. 2. Assess study quality, extract data, and perform meta-analysis when applicable.			

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	3. Use tools like the PRISMA checklist for quality assessment. 4. Ensure transparency and reproducibility in the process. 5. Critically analyze and report findings, addressing limitations and conclusions.			
eta-Analysis hr	1. Define the concept and purpose of meta-analysis in synthesizing data from multiple studies. 2. Learn how to select studies, extract data, and assess study quality for inclusion in meta-analysis. 3. Describe statistical methods used in meta-analysis, such as effect sizes and heterogeneity assessment. 4. Interpret meta-analysis results, including pooled estimates and confidence intervals. 5. Learn how to assess and handle publication bias and other potential biases.			
Introduction to Qualitative Studies 1 hr	1. Define the purpose and significance of qualitative research in exploring human experiences and behaviors. 2. Learn key qualitative research methods, such as interviews, focus groups, and observations. 3. Describe data collection, coding, and thematic analysis techniques in qualitative research. 4. Familiarize with the principles of data saturation, validity, and reliability in qualitative studies. 5. Develop skills in interpreting and presenting qualitative findings to inform research and practice.			

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