MANIPAL UNIVERSITY

FRIST YEAR MASLP / MSc. MLT / MSc. NMT / MSc. MIT / SECOND SEMESTER M.Sc. CLINICAL PSYCHOLOGY / MSc MRP / M.Sc. HHIA / MSc MIT DEGREE EXAMINATION – DECEMBER 2016

SUBJECT: STATISTICS & RESEARCH METHODS (SH 101) / BIOSTATISTICS / ADVANCED BIOSTATISTICS & RESEARCH METHODOLOGY (PAPER IV) / BIOSTATISTICS / ADVANCED BIOSTATISTICS & RESEARCH METHODOLOGY (MCP 106) / RESEARCH METHODOLOGY & BIOSTATISTICS / EPIDEMIOLOGY & BIOSTATISTICS (MHI 606) / BIOSTATISTICS (MIT 203)

Thursday, December 15, 2016

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ **Answer ALL the questions.**

1A. Define mean, median, mode, standard deviation and coefficient of variation.

1B. Define sample and sampling.

1C. What are the characteristics of a good sample?

(5+2+3 = 10 marks)

2A. Define sampling distribution and standard error.

2B. Explain the formula for 95% confidence interval for:
   i)   Mean
   ii) Proportion
   iii) Difference between two means
   iv) Difference between two proportions

(2+ (2 marks × 4) = 10 marks)

3A. Explain the test used for comparing the mean of a variable before and after an intervention in a sample of individuals.

3B. In a survey, 246 urban school children and 349 rural school children were examined for conductive hearing loss. Out of 246 urban children, 36 suffered from conductive hearing loss while among rural school children 61 suffered with hearing loss. Test whether the proportion of hearing loss differs between urban and rural children at 5% level of significance. The table value is given as 3.84.

(5+5 = 10 marks)

4. Discuss with suitable examples:
   i)   ANOVA   ii)   Repeated measures ANOVA

(5+5 = 10 marks)

5. Explain the design, analysis, merits and demerits of a randomized controlled trial.

(10 marks)

6A. Describe cross sectional study design with an example.

6B. A study has been planned to compare the mean hearing thresholds levels between urban and rural children. How many children are required in each group if an average difference of 4 decibels is considered as clinically important with 80% power and 1% level of significance? The standard deviation of hearing threshold level is expected to be 7 decibels. The table value for 80% power and 1% level of significance is 0.84 and 2.58 respectively.

(5+5 = 10 marks)

7. Explain the structure of a research protocol.

(10 marks)

8. **Write short notes on:**

8A. Reliability of a diagnostic test

8B. Systematic reviews and meta-analysis

(5+5 = 10 marks)

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FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – DECEMBER 2016

SUBJECT: PAPER III: MATHEMATICS IN NUCLEAR MEDICINE – I, STATISTICS – I
(NEW REGULATION)

Friday, December 16, 2016

Time: 10:00 – 13:00 Hrs.   Max. Marks: 80

✍   **Answer ALL the questions:**

1A. Find out the value of x from the equation: $x \tan 30°. \cos^2 45° = \frac{\cot^2 30° \tan 45°}{\sec 30°}$

1B. Solve simultaneous equation $4x - 3y = 0$; $2x - y = 0$

1C. State and prove Lagrange's Mean value theorem

1D. Define periodic function, polynomial function, even function and odd function.

(3+2+3+2 = 10 marks)

2A. What is the distance required to reduce the radiation level from cobalt-60 source of activity 1.5GBq to 0.025mGy/hr? (k-factor- 0.31 mGy/h/GBq)

2B. Find the values of 4 pixels from the provided 6 bin values using the method of algebraic reconstruction technique.
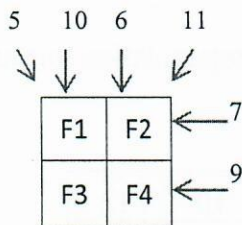
(4+6 = 10 marks)

3A. Find the scalar product of the vectors pairs of: 2i+j and 3j+2k.

3B. Find the value of λ so that the pairs of dot vectors 6i+ λ j-2k and 2i+2j+11k are perpendicular to each other.

3C. Express the complex numbers $1 + \sqrt{3}$ i in the polar form and hence find their modulus and amplitude.

(3+3+4 = 10 marks)

4A. To prove that, $\frac{d(\sin x)}{dx} = \cos x$

4B. Differentiate: (x log x) / (x-1)

4C. Evaluate $\int_0^{2\pi} \sin^2 x \cos^2 x \, dx$

(3+3+4 = 10 marks)

5A. Find the maximum/minimum values of the function: $2x + 3x - 12x - 4$

5B. Solve $dy/dx + xy = xy^2$

5C. Evaluate $\int x \sin x \, dx$

$$(4+3+3 = 10 \text{ marks})$$

6A. Deduce the appropriate compartment model.

$dV_1/dt = k_{01}V_0 + k_{21}V_2 + k_{41}V_4 - k_{12}V_1 - k_{14}V_1$

$dV_2/dt = k_{12}V_1 - k_{21}V_2 - k_{23}V_2$; $dV_3/dt = k_{23}V_2 - k_{30}V_3$;

$dV_4/dt = k_{14}V_1 - k_{41}V_4 - k_{45}V_4$; $dV_5/dt = k_{45}V_4 - k_{50}V_5$

6B. $2/3 \log (16/15) + \log (25/24) - \log (32/27) = 0$

6C. Find x if $\log_x 16 = 2/5$

$$(5+3+2 = 10 \text{ marks})$$

7A. Explain Fourier central Slice theorem used in SPECT image reconstruction

7B. Find the Inverse of the square matrix $A = \begin{bmatrix} 2 & 5 & 1 \\ 3 & 1 & 2 \\ 4 & 3 & 1 \end{bmatrix}$

$$(4+6 = 10 \text{ marks})$$

8A. Convert 400 mCi into GBq.

8B. Evaluate: $\underset{x \to 0}{Lt} \dfrac{\sqrt{(1+x)} - 1}{x}$

8C. Find the counts at pixel3 (p_3) by using Newton's interpolation formula. Data are given below:

Pixel no.	2	4	6	8	10	12
Counts	100k	120k	130k	150k	160k	170k

$$(2+2+6 = 10 \text{ marks})$$

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FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – DECEMBER 2016

SUBJECT: PAPER IX: NUCLEAR MEDICINE INSTRUMENTATION – I
(NEW REGULATION)

Saturday, December 17, 2016

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ **Answer ALL the questions.**

✍ **Draw neat and labeled diagram as and when required.**

1. Describe how pulse height spectra with excellent energy resolution are generated.

(20 marks)

2. How images were generated using a rectilinear scanner?

(20 marks)

3. **Write short notes on the following:**

3A. Sample volume effect

3B. Ideal characteristics of a probe

3C. MTF

3D. Calibration of whole body counters

3E. Coincidence circuit

3F. Neutron detectors

(5 marks × 6 = 30 marks)

4A. Explain the estimating required counting times of experiment and optimal division of counting time.

4B. Preliminary measurements in a sample counting procedure indicate gross and background counting rate of R_g=900 cpm R_b = 100 cpm respectively. Find optimal of a 1.25 minute total counting time and the resulting uncertainty in the net sample counting rate.

(5+5 = 10 marks)

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