**M.TECH/RE/1ST SEM/REEN 5103/2020**

# RESEARCH METHODOLOGY AND IPR

# (REEN 5103)

**Time Allotted : 3 hrs** **Full Marks : 70**

***Figures out of the right margin indicate full marks.***

***Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.***

***Candidates are required to give answer in their own words as far as practicable.***

## Group – A
## (Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Identify the clause which is not related with DOI number of Research Paper.
(a) Digital Object Identifier (b) starts with 10
(c) indicates the commercial value (d) provided by Figshare

(ii) In a Research Thesis Assay Technique is a part of
(a) Theoretical Analysis (b) Aims and Objectives
(c) Materials and Methods (d) Results and Discussion

(iii) The number of Class Intervals for making distribution using 400 numbers of discrete data points are about
(a) 5 (b) 20
(c) 100 (d) none of the above

(iv) Descriptive Statistics is:
(a) expression of beauty of nature (b) application of probability measure
(c) a Stochastic process (d) summarizes the properties of data

(v) Brainstorming is
(a) a basic TQM tool (b) A stochastic analysis
(c) synonymous with Ishikawa diagram (d) ABC analysis

(vi) The names of Four Software are given below whereby three would serve same purpose, identify the odd one
(a) MS- Excel (b) Origin Lab
(c) Autocad (d) Apple Page

(vii) The Deming cycle also means
(a) Carnot cycle (b) Kaizen
(c) PDCA Cycle (d) Linde Cycle

(viii) Control Chart in SQC is invented by
(a) Dodge- Romig (b) Shewart
(c) Peter Drucker (d) Aris

(ix) Type II error is synonymous with
(a) Consumer's Risk (b) Producer's Risk
(c) Quality Control Professional's Risk (d) Benefit of everyone

(x) Interpretation of ANOVA needs
(a) t- distribution chart (b) Chi-square distribution Chart
(c) Gantt Chart (d) F distribution chart

## Group – B

2. (a) Enumerate six steps of a Research report.

(b) Discuss the methodology of conducting an effective Brainstorming.

**6 + 6 = 12**

3. What is the role of a Coordinator in a Quality Circle? A Q.C. was formed in a manufacturing unit of a Renewable Energy Industry. In the first meeting an effective brainstorming was conducted and the circle identified a problem pertaining to the same work area. In a next meeting the members identified 24 causes of the selected problem under four sub-heads. Considering you to be the leader of the circle present this case study and draw an Ishikawa diagram.

**6 + 6 = 12**

## Group – C

4. Shipments of Toilet Soap arrive in batches of 500 pieces each. The inward inspection involves testing which could be destructive and therefore, a sample of 15 items is taken. A batch is accepted only if one or nil of the items in the sample is found to be below the desired quality.

Under this sampling plan, what are the probabilities of:
Rejecting a shipment that has two per cent defectives, and
Accepting a shipment that is bad enough to contain 10 per cent defectives?

**3 + 9 = 12**

5. A random variable X is distributed at random between the values 0 and 1 so that its probability density function is $f(x) = k x^2(1- x^3)$, where $k$ is a constant. Find the value of $k$, the mean and standard deviation of the distribution

**12**

## Group – D

6. An engineer has studied the formulation of a Portland cement mortal, by adding a polymer latex emulsion during mixing to determine if this impacts the curing time and tension bond strength of the mortar. The investigation data are given below

| Sl No | Modified Mortar ($y_{1j}$) | Unmodified mortar ($y_{2j}$) |
|---|---|---|
| 1 | 16.85 | 17.50 |
| 2 | 16.40 | 17.63 |
| 3 | 17.21 | 18.25 |
| 4 | 16.35 | 18.00 |
| 5 | 16.52 | 17.86 |
| 6 | 17.04 | 17.75 |
| 7 | 16.96 | 18.22 |
| 8 | 17.15 | 17.90 |
| 9 | 16.59 | 17.96 |
| 10 | 16.57 | 18.15 |

Conduct necessary statistical inference and draw your conclusion.

7. (a) Formulate a two-factor Design of Experiment model without interactions

   (b) Calculate degrees of freedom at each level.

**6 + 6 = 12**

## Group – E

8. What is MS-excel solver? Discuss how to obtain a trial solution of an equation using MS—excel. What is Google's Scholar Citation?

**4 + 5 + 3 = 12**

9. (a) Enumerate the steps for filing a patent in India.

   (b) What is third party IP rights?

**8 + 4 = 12**

| Department & Section | Submission Link |
|---|---|
| RE | https://classroom.google.com/c/MjA3ODg0MzEzODc2/a/Mjk5MzE1ODYxNjgy/details |

## II Percentage Points of the $t$ Distribution[a]

| $\nu$ \ $\alpha$ | 0.40 | 0.25 | 0.10 | 0.05 | 0.025 | 0.01 | 0.005 | 0.0025 | 0.001 | 0.0005 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.325 | 1.000 | 3.078 | 6.314 | 12.706 | 31.821 | 63.657 | 127.32 | 318.31 | 636.62 |
| 2 | 0.289 | 0.816 | 1.886 | 2.920 | 4.303 | 6.965 | 9.925 | 14.089 | 23.326 | 31.598 |
| 3 | 0.277 | 0.765 | 1.638 | 2.353 | 3.182 | 4.541 | 5.841 | 7.453 | 10.213 | 12.924 |
| 4 | 0.271 | 0.741 | 1.533 | 2.132 | 2.776 | 3.747 | 4.604 | 5.598 | 7.173 | 8.610 |
| 5 | 0.267 | 0.727 | 1.476 | 2.015 | 2.571 | 3.365 | 4.032 | 4.773 | 5.893 | 6.869 |
| 6 | 0.265 | 0.727 | 1.440 | 1.943 | 2.447 | 3.143 | 3.707 | 4.317 | 5.208 | 5.959 |
| 7 | 0.263 | 0.711 | 1.415 | 1.895 | 2.365 | 2.998 | 3.499 | 4.019 | 4.785 | 5.408 |
| 8 | 0.262 | 0.706 | 1.397 | 1.860 | 2.306 | 2.896 | 3.355 | 3.833 | 4.501 | 5.041 |
| 9 | 0.261 | 0.703 | 1.383 | 1.833 | 2.262 | 2.821 | 3.250 | 3.690 | 4.297 | 4.781 |
| 10 | 0.260 | 0.700 | 1.372 | 1.812 | 2.228 | 2.764 | 3.169 | 3.581 | 4.144 | 4.587 |
| 11 | 0.260 | 0.697 | 1.363 | 1.796 | 2.201 | 2.718 | 3.106 | 3.497 | 4.025 | 4.437 |
| 12 | 0.259 | 0.695 | 1.356 | 1.782 | 2.179 | 2.681 | 3.055 | 3.428 | 3.930 | 4.318 |
| 13 | 0.259 | 0.694 | 1.350 | 1.771 | 2.160 | 2.650 | 3.012 | 3.372 | 3.852 | 4.221 |
| 14 | 0.258 | 0.692 | 1.345 | 1.761 | 2.145 | 2.624 | 2.977 | 3.326 | 3.787 | 4.140 |
| 15 | 0.258 | 0.691 | 1.341 | 1.753 | 2.131 | 2.602 | 2.947 | 3.286 | 3.733 | 4.073 |
| 16 | 0.258 | 0.690 | 1.337 | 1.746 | 2.120 | 2.583 | 2.921 | 3.252 | 3.686 | 4.015 |
| 17 | 0.257 | 0.689 | 1.333 | 1.740 | 2.110 | 2.567 | 2.898 | 3.222 | 3.646 | 3.965 |
| 18 | 0.257 | 0.688 | 1.330 | 1.734 | 2.101 | 2.552 | 2.878 | 3.197 | 3.610 | 3.922 |
| 19 | 0.257 | 0.688 | 1.328 | 1.729 | 2.093 | 2.539 | 2.861 | 3.174 | 3.579 | 3.883 |
| 20 | 0.257 | 0.687 | 1.325 | 1.725 | 2.086 | 2.528 | 2.845 | 3.153 | 3.552 | 3.850 |
| 21 | 0.257 | 0.686 | 1.323 | 1.721 | 2.080 | 2.518 | 2.831 | 3.135 | 3.527 | 3.819 |
| 22 | 0.256 | 0.686 | 1.321 | 1.717 | 2.074 | 2.508 | 2.819 | 3.119 | 3.505 | 3.792 |
| 23 | 0.256 | 0.685 | 1.319 | 1.714 | 2.069 | 2.500 | 2.807 | 3.104 | 3.485 | 3.767 |
| 24 | 0.256 | 0.685 | 1.318 | 1.711 | 2.064 | 2.492 | 2.797 | 3.091 | 3.467 | 3.745 |
| 25 | 0.256 | 0.684 | 1.316 | 1.708 | 2.060 | 2.485 | 2.787 | 3.078 | 3.450 | 3.725 |
| 26 | 0.256 | 0.684 | 1.315 | 1.706 | 2.056 | 2.479 | 2.779 | 3.067 | 3.435 | 3.707 |
| 27 | 0.256 | 0.684 | 1.314 | 1.703 | 2.052 | 2.473 | 2.771 | 3.057 | 3.421 | 3.690 |
| 28 | 0.256 | 0.683 | 1.313 | 1.701 | 2.048 | 2.467 | 2.763 | 3.047 | 3.408 | 3.674 |
| 29 | 0.256 | 0.683 | 1.311 | 1.699 | 2.045 | 2.462 | 2.756 | 3.038 | 3.396 | 3.659 |
| 30 | 0.256 | 0.683 | 1.310 | 1.697 | 2.042 | 2.457 | 2.750 | 3.030 | 3.385 | 3.646 |
| 40 | 0.255 | 0.681 | 1.303 | 1.684 | 2.021 | 2.423 | 2.704 | 2.971 | 3.307 | 3.551 |
| 60 | 0.254 | 0.679 | 1.296 | 1.671 | 2.000 | 2.390 | 2.660 | 2.915 | 3.232 | 3.460 |
| 120 | 0.254 | 0.677 | 1.289 | 1.658 | 1.980 | 2.358 | 2.617 | 2.860 | 3.160 | 3.373 |
| $\infty$ | 0.253 | 0.674 | 1.282 | 1.645 | 1.960 | 2.326 | 2.576 | 2.807 | 3.090 | 3.291 |

$\nu$ = Degrees of freedom.

[a]Adapted with permission from *Biometrika Tables for Statisticians*, Vol. 1, 3rd edition, by E. S. Pearson and H. O. Hartley, Cambridge University Press, Cambridge, 1966.