

[This question paper contains 16 printed pages.]

Your Roll No. ....

Sr. No. of Question Paper : 5120

G

Unique Paper Code : 12273303

Name of the Paper : Data Analysis

Name of the Course : B.A. (H) Economics – SEC

Semester : III

Duration : 3 Hour

Maximum Marks : 65

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. This question paper has two sections. Attempt any TWO questions from each section.
3. You do not require the use of R or Excel software to answer any question. Wherever asked, mention/discuss the command/function/syntax, as required in the question.
4. The questions in which R or Excel is not mentioned, the answers should be based on your own calculations.
5. Use of a simple non-programmable calculator is allowed.
6. Statistical tables are attached for your reference.

**SECTION A**

1. (a) The Principal at a college emailed a survey to a total of 300 students. The sample included 100 students randomly selected from each of the first year, second year, and third year of the college.

P.T.O.

- (i) What type of sampling method was used? (2)
- (ii) Explain why the sampling method stated in (i) is the most efficient method. (3)
- (iii) How is the sampling method described above different from non-probability sampling? Explain. (5)
- (b) Differentiate between excel functions RAND() and RANDBETWEEN(). (3)
- (c) Explain rep() command in R using an example. (3)
2. (a) The following data represents the stress score and life satisfaction score collected from a sample of 10 participants :

| Stress Score | Life satisfaction score |
|--------------|-------------------------|
| 11           | 7                       |
| 25           | 1                       |
| 19           | 4                       |
| 7            | 9                       |
| 23           | 2                       |
| 6            | 8                       |
| 11           | 8                       |
| 22           | 3                       |
| 25           | 3                       |
| 10           | 6                       |



Using this data, answer the following questions :

- (i) Compute sample correlation coefficient between the stress scores and life satisfaction scores. Comment on the correlation between the two. (5)
  - (ii) Calculate the Z scores of stress scores. Are there any outliers? (5)
- (b) Explain data frame with the help of an example, in R. (3)
- (c) Suppose 10 numbers are given in Excel from the cell A1 to A10. Explain the excel function to calculate mean of these 10 numbers. (3)
3. (a) Using examples, elaborate the methods used to organise categorical variables. (5)
- (b) Discuss the challenges faced in organizing and visualizing variables. (5)
- (c) Explain the use of filter in Excel. (3)
- (d) Write R commands for rolling a six-sided fair dice. (3)

### SECTION B

4. (a) Answer the following questions :

P.T.O.

(i) A coin is tossed at random 400 times and heads turn up 240 times. Can the coin be regarded as unbiased? Use 5% level of significance. (4)

(ii) How will the result in (i) be affected if the observed number of heads is 216? Use 5% level of significance. (2)

(b) Two random samples of sizes 8 and 11, drawn from two normal populations, are characterized as follows :

| Population from which sample is drawn | Sample Size | Sum of Observations | Sum of squares of observations |
|---------------------------------------|-------------|---------------------|--------------------------------|
| I                                     | 8           | 9.6                 | 61.52                          |
| II                                    | 11          | 16.5                | 73.26                          |

You are to decide if the two populations can be taken to have the same variance. Which test function would you use? How is it distributed? Test the above hypothesis at 5% level of significance. (6)

(c) Explain the difference between `getwd()` and `setwdQ` commands in R.

(4.5)

5. (a) A manufacturing company wants to estimate the average amount of purchase of its product in a month by the customers. If the standard deviation is Rs. 10, find the sample size if the maximum error is not to exceed Rs. 3 with a confidence level of 99%. How will the sample size change if the confidence level changes to 90%? (6)

- (b) The data for number of days present per week for a population of three employees, namely, Rishi, Radhika and Shanti of an organization is given below :

| Employee | Number of Days |
|----------|----------------|
| Rishi    | 5              |
| Radhika  | 6              |
| Shanti   | 4              |

Suppose you select samples of two administrative assistants *with* replacement from this population. Calculate the sampling distribution of sample mean. Compare it with the population mean number of days present. Are the two equal? Why or why not? (6)

- (c) Explain the use of the following R commands: `read.csv` and `read.table`.

(4.5)

P.T.O.

6. (a) A study is conducted to see if wages of daily workers in North and South India differ from each other. Results for two-sample t-tests, assuming equal variances, for wages, are given below :

| Two Sample t Test Assuming Equal Variances |             |             |
|--|-------------|-------------|
|  | North India | South India |
| Mean                                       | 12          | 10          |
| Variance                                   | 16          | 9           |
| Observations                               | 4           | 5           |
| Pooled Variance                            | 12          |             |
| Hypothesized Mean Difference               | 0           |             |
| df   | 7           |             |
| t Stat                                     | 0.861       |             |
| P(T<=t) two tail                           | 0.418       |             |
| P(T<=t) one tail                           | 0.209       |             |
| T critical two tail at 1%                  | 3.496       |             |
| T critical one tail at 1%                  | 2.998       |             |

- (i) State the null and alternative hypotheses to test if the average daily wage in North India differs from average daily wage in South India.

(2)

- (ii) At 1% level of significance, is there an evidence of difference in wages?

Also test the hypothesis that average wages in North India are greater than those in South India.

(6)



- (iii) Test the hypothesis stated in part (ii) again at 5% and 10% level of significance using p-value approach. (2)
- (b) Explain the use of Excel function : NORM.S.DIST (3.5)
- (c) Explain the use of the following R command using example: ls() (3)

P.T.O.

TABLE B.2  
The Cumulative Standard Normal Distribution

Entry corresponds to the cumulative standardized normal distribution from  $-\infty$  to  $z$ .



| Cumulative Probabilities |          |          |          |          |          |          |          |          |          |          |
|--------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| $z$                      | 0.00     | 0.01     | 0.02     | 0.03     | 0.04     | 0.05     | 0.06     | 0.07     | 0.08     | 0.09     |
| -6.0                     | 0.000000 |          |          |          |          |          |          |          |          |          |
| -5.5                     | 0.000001 |          |          |          |          |          |          |          |          |          |
| -5.0                     | 0.000001 |          |          |          |          |          |          |          |          |          |
| -4.5                     | 0.000002 |          |          |          |          |          |          |          |          |          |
| -4.0                     | 0.000003 |          |          |          |          |          |          |          |          |          |
| -3.5                     | 0.000005 | 0.000004 | 0.000003 | 0.000002 | 0.000001 | 0.000001 | 0.000001 | 0.000001 | 0.000001 | 0.000001 |
| -3.0                     | 0.000007 | 0.000006 | 0.000005 | 0.000004 | 0.000003 | 0.000002 | 0.000002 | 0.000002 | 0.000002 | 0.000002 |
| -2.5                     | 0.000011 | 0.000010 | 0.000009 | 0.000008 | 0.000007 | 0.000006 | 0.000005 | 0.000005 | 0.000005 | 0.000005 |
| -2.0                     | 0.000016 | 0.000015 | 0.000014 | 0.000013 | 0.000012 | 0.000011 | 0.000011 | 0.000010 | 0.000010 | 0.000010 |
| -1.5                     | 0.000023 | 0.000022 | 0.000021 | 0.000020 | 0.000019 | 0.000018 | 0.000017 | 0.000017 | 0.000016 | 0.000016 |
| -1.0                     | 0.000034 | 0.000033 | 0.000032 | 0.000031 | 0.000030 | 0.000029 | 0.000028 | 0.000027 | 0.000027 | 0.000026 |
| -0.5                     | 0.000048 | 0.000047 | 0.000046 | 0.000045 | 0.000044 | 0.000043 | 0.000042 | 0.000041 | 0.000041 | 0.000040 |
| 0.0                      | 0.000069 | 0.000068 | 0.000067 | 0.000066 | 0.000065 | 0.000064 | 0.000063 | 0.000062 | 0.000062 | 0.000061 |
| 0.5                      | 0.000097 | 0.000094 | 0.000091 | 0.000088 | 0.000085 | 0.000082 | 0.000079 | 0.000076 | 0.000073 | 0.000070 |
| 1.0                      | 0.000134 | 0.000131 | 0.000128 | 0.000125 | 0.000122 | 0.000119 | 0.000116 | 0.000113 | 0.000110 | 0.000107 |
| 1.5                      | 0.000219 | 0.000215 | 0.000212 | 0.000209 | 0.000206 | 0.000203 | 0.000200 | 0.000197 | 0.000194 | 0.000191 |
| 2.0                      | 0.000344 | 0.000340 | 0.000337 | 0.000334 | 0.000331 | 0.000328 | 0.000325 | 0.000322 | 0.000319 | 0.000316 |
| 2.5                      | 0.000478 | 0.000474 | 0.000471 | 0.000468 | 0.000465 | 0.000462 | 0.000459 | 0.000456 | 0.000453 | 0.000450 |
| 3.0                      | 0.000594 | 0.000590 | 0.000587 | 0.000584 | 0.000581 | 0.000578 | 0.000575 | 0.000572 | 0.000569 | 0.000566 |
| 3.5                      | 0.000690 | 0.000687 | 0.000684 | 0.000681 | 0.000678 | 0.000675 | 0.000672 | 0.000669 | 0.000666 | 0.000663 |
| 4.0                      | 0.000770 | 0.000767 | 0.000764 | 0.000761 | 0.000758 | 0.000755 | 0.000752 | 0.000749 | 0.000746 | 0.000743 |
| 4.5                      | 0.000854 | 0.000851 | 0.000848 | 0.000845 | 0.000842 | 0.000839 | 0.000836 | 0.000833 | 0.000830 | 0.000827 |
| 5.0                      | 0.000938 | 0.000935 | 0.000932 | 0.000929 | 0.000926 | 0.000923 | 0.000920 | 0.000917 | 0.000914 | 0.000911 |
| 5.5                      | 0.000985 | 0.000982 | 0.000979 | 0.000976 | 0.000973 | 0.000970 | 0.000967 | 0.000964 | 0.000961 | 0.000958 |
| 6.0                      | 0.000997 | 0.000994 | 0.000991 | 0.000988 | 0.000985 | 0.000982 | 0.000979 | 0.000976 | 0.000973 | 0.000970 |
| 6.5                      | 0.000999 | 0.000996 | 0.000993 | 0.000990 | 0.000987 | 0.000984 | 0.000981 | 0.000978 | 0.000975 | 0.000972 |
| 7.0                      | 0.000999 | 0.000996 | 0.000993 | 0.000990 | 0.000987 | 0.000984 | 0.000981 | 0.000978 | 0.000975 | 0.000972 |
| 7.5                      | 0.000999 | 0.000996 | 0.000993 | 0.000990 | 0.000987 | 0.000984 | 0.000981 | 0.000978 | 0.000975 | 0.000972 |
| 8.0                      | 0.000999 | 0.000996 | 0.000993 | 0.000990 | 0.000987 | 0.000984 | 0.000981 | 0.000978 | 0.000975 | 0.000972 |
| 8.5                      | 0.000999 | 0.000996 | 0.000993 | 0.000990 | 0.000987 | 0.000984 | 0.000981 | 0.000978 | 0.000975 | 0.000972 |
| 9.0                      | 0.000999 | 0.000996 | 0.000993 | 0.000990 | 0.000987 | 0.000984 | 0.000981 | 0.000978 | 0.000975 | 0.000972 |
| 9.5                      | 0.000999 | 0.000996 | 0.000993 | 0.000990 | 0.000987 | 0.000984 | 0.000981 | 0.000978 | 0.000975 | 0.000972 |
| 10.0                     | 0.000999 | 0.000996 | 0.000993 | 0.000990 | 0.000987 | 0.000984 | 0.000981 | 0.000978 | 0.000975 | 0.000972 |

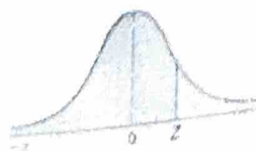


TABLE E.2

The Cumulative Standardized Normal Distribution (continued)  
 Entry represents area under the cumulative standardized  
 normal distribution from  $-\infty$  to  $Z$

APPENDIX E Table

665



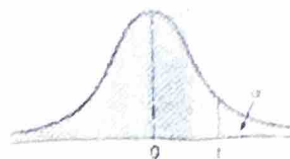
| Z   | Cumulative Probabilities |        |        |        |        |        |        |        |        |        |
|-----|--------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|     | 0.00                     | 0.01   | 0.02   | 0.03   | 0.04   | 0.05   | 0.06   | 0.07   | 0.08   | 0.09   |
| 0.0 | 0.5000                   |        |        |        |        |        |        |        |        |        |
| 0.1 | 0.5398                   | 0.5040 | 0.5080 | 0.5120 | 0.5160 | 0.5199 | 0.5239 | 0.5279 | 0.5319 | 0.5359 |
| 0.2 | 0.5793                   | 0.5438 | 0.5478 | 0.5517 | 0.5557 | 0.5596 | 0.5636 | 0.5675 | 0.5714 | 0.5753 |
| 0.3 | 0.6179                   | 0.5832 | 0.5871 | 0.5910 | 0.5948 | 0.5987 | 0.6026 | 0.6064 | 0.6103 | 0.6141 |
| 0.4 | 0.6554                   | 0.6217 | 0.6255 | 0.6293 | 0.6331 | 0.6368 | 0.6406 | 0.6443 | 0.6480 | 0.6517 |
| 0.5 | 0.6915                   | 0.6591 | 0.6628 | 0.6664 | 0.6700 | 0.6736 | 0.6772 | 0.6808 | 0.6844 | 0.6879 |
| 0.6 | 0.7257                   | 0.6950 | 0.6985 | 0.7019 | 0.7054 | 0.7088 | 0.7123 | 0.7157 | 0.7190 | 0.7224 |
| 0.7 | 0.7580                   | 0.7291 | 0.7324 | 0.7357 | 0.7389 | 0.7422 | 0.7454 | 0.7486 | 0.7518 | 0.7549 |
| 0.8 | 0.7881                   | 0.7612 | 0.7642 | 0.7673 | 0.7704 | 0.7734 | 0.7764 | 0.7794 | 0.7823 | 0.7852 |
| 0.9 | 0.8159                   | 0.7910 | 0.7939 | 0.7967 | 0.7995 | 0.8023 | 0.8051 | 0.8078 | 0.8106 | 0.8133 |
| 1.0 | 0.8413                   | 0.8186 | 0.8212 | 0.8238 | 0.8264 | 0.8289 | 0.8315 | 0.8340 | 0.8365 | 0.8389 |
| 1.1 | 0.8643                   | 0.8438 | 0.8461 | 0.8485 | 0.8508 | 0.8531 | 0.8554 | 0.8577 | 0.8599 | 0.8621 |
| 1.2 | 0.8849                   | 0.8665 | 0.8686 | 0.8708 | 0.8729 | 0.8749 | 0.8770 | 0.8790 | 0.8810 | 0.8830 |
| 1.3 | 0.9032                   | 0.8869 | 0.8888 | 0.8907 | 0.8925 | 0.8944 | 0.8962 | 0.8980 | 0.8997 | 0.9015 |
| 1.4 | 0.9192                   | 0.9049 | 0.9066 | 0.9082 | 0.9099 | 0.9115 | 0.9131 | 0.9147 | 0.9162 | 0.9177 |
| 1.5 | 0.9332                   | 0.9207 | 0.9222 | 0.9236 | 0.9251 | 0.9265 | 0.9279 | 0.9292 | 0.9306 | 0.9319 |
| 1.6 | 0.9452                   | 0.9345 | 0.9357 | 0.9370 | 0.9382 | 0.9394 | 0.9406 | 0.9418 | 0.9429 | 0.9441 |
| 1.7 | 0.9554                   | 0.9463 | 0.9474 | 0.9484 | 0.9495 | 0.9505 | 0.9515 | 0.9525 | 0.9535 | 0.9545 |
| 1.8 | 0.9641                   | 0.9564 | 0.9573 | 0.9582 | 0.9591 | 0.9599 | 0.9608 | 0.9616 | 0.9625 | 0.9633 |
| 1.9 | 0.9713                   | 0.9649 | 0.9656 | 0.9664 | 0.9671 | 0.9678 | 0.9686 | 0.9693 | 0.9699 | 0.9706 |
| 2.0 | 0.9772                   | 0.9719 | 0.9726 | 0.9732 | 0.9738 | 0.9744 | 0.9750 | 0.9756 | 0.9761 | 0.9767 |
| 2.1 | 0.9821                   | 0.9778 | 0.9783 | 0.9788 | 0.9793 | 0.9798 | 0.9803 | 0.9808 | 0.9812 | 0.9817 |
| 2.2 | 0.9861                   | 0.9826 | 0.9830 | 0.9834 | 0.9838 | 0.9842 | 0.9846 | 0.9850 | 0.9854 | 0.9857 |
| 2.3 | 0.9893                   | 0.9864 | 0.9868 | 0.9871 | 0.9875 | 0.9878 | 0.9881 | 0.9884 | 0.9887 | 0.9890 |
| 2.4 | 0.9918                   | 0.9896 | 0.9898 | 0.9901 | 0.9904 | 0.9906 | 0.9909 | 0.9911 | 0.9913 | 0.9916 |
| 2.5 | 0.9938                   | 0.9920 | 0.9922 | 0.9925 | 0.9927 | 0.9929 | 0.9931 | 0.9932 | 0.9934 | 0.9936 |
| 2.6 | 0.9953                   | 0.9940 | 0.9941 | 0.9943 | 0.9945 | 0.9946 | 0.9948 | 0.9949 | 0.9951 | 0.9952 |
| 2.7 | 0.9965                   | 0.9955 | 0.9956 | 0.9957 | 0.9959 | 0.9960 | 0.9961 | 0.9962 | 0.9963 | 0.9964 |
| 2.8 | 0.9974                   | 0.9966 | 0.9967 | 0.9968 | 0.9969 | 0.9970 | 0.9971 | 0.9972 | 0.9973 | 0.9974 |
| 2.9 | 0.9981                   | 0.9975 | 0.9976 | 0.9977 | 0.9977 | 0.9978 | 0.9979 | 0.9979 | 0.9980 | 0.9981 |
| 3.0 | 0.9981                   | 0.9982 | 0.9982 | 0.9983 | 0.9984 | 0.9984 | 0.9985 | 0.9985 | 0.9986 | 0.9986 |
| 3.1 | 0.9986                   | 0.9986 | 0.9987 | 0.9987 | 0.9988 | 0.9988 | 0.9988 | 0.9989 | 0.9989 | 0.9990 |
| 3.2 | 0.9990                   | 0.9990 | 0.9991 | 0.9991 | 0.9991 | 0.9991 | 0.9992 | 0.9992 | 0.9992 | 0.9992 |
| 3.3 | 0.9993                   | 0.9993 | 0.9993 | 0.9993 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9995 |
| 3.4 | 0.9995                   | 0.9995 | 0.9995 | 0.9995 | 0.9996 | 0.9996 | 0.9996 | 0.9996 | 0.9996 | 0.9996 |
| 3.5 | 0.9996                   | 0.9996 | 0.9996 | 0.9996 | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9997 |
| 3.6 | 0.9997                   | 0.9997 | 0.9997 | 0.9997 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 |
| 3.7 | 0.9998                   | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 |
| 3.8 | 0.9999                   | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 |
| 3.9 | 0.9999                   | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 |
| 4.0 | 0.9999                   | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 |
| 4.5 | 0.9999                   | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 |
| 5.0 | 0.9999                   | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 |
| 5.5 | 0.9999                   | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 |
| 6.0 | 0.9999                   | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 |

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TABLE E.3

Critical Values of  $t$ 

For a particular number of degrees of freedom, entry represents the critical value of  $t$  corresponding to the cumulative probability  $(1 - \alpha)$  and a specified upper-tail area ( $\alpha$ )



| Degrees of Freedom | Cumulative Probabilities |        |        |         |         |         |
|--------------------|--------------------------|--------|--------|---------|---------|---------|
|                    | 0.75                     | 0.90   | 0.95   | 0.975   | 0.99    | 0.995   |
|                    | Upper-Tail Areas         |        |        |         |         |         |
|                    | 0.25                     | 0.10   | 0.05   | 0.025   | 0.01    | 0.005   |
| 1                  | 1.0000                   | 3.0777 | 6.3138 | 12.7062 | 31.8207 | 63.6574 |
| 2                  | 0.8165                   | 1.8856 | 2.9200 | 4.3027  | 6.9646  | 9.9248  |
| 3                  | 0.7649                   | 1.6377 | 2.3534 | 3.1824  | 4.5407  | 5.8409  |
| 4                  | 0.7407                   | 1.5332 | 2.1318 | 2.7764  | 3.7469  | 4.6041  |
| 5                  | 0.7267                   | 1.4759 | 2.0150 | 2.5706  | 3.3649  | 4.0322  |
| 6                  | 0.7176                   | 1.4398 | 1.9432 | 2.4469  | 3.1427  | 3.7074  |
| 7                  | 0.7111                   | 1.4149 | 1.8946 | 2.3646  | 2.9980  | 3.4995  |
| 8                  | 0.7064                   | 1.3968 | 1.8595 | 2.3060  | 2.8965  | 3.3554  |
| 9                  | 0.7027                   | 1.3830 | 1.8331 | 2.2622  | 2.8214  | 3.2498  |
| 10                 | 0.6998                   | 1.3722 | 1.8125 | 2.2281  | 2.7638  | 3.1693  |
| 11                 | 0.6974                   | 1.3634 | 1.7959 | 2.2010  | 2.7181  | 3.1058  |
| 12                 | 0.6955                   | 1.3562 | 1.7823 | 2.1788  | 2.6810  | 3.0545  |
| 13                 | 0.6938                   | 1.3502 | 1.7709 | 2.1604  | 2.6503  | 3.0123  |
| 14                 | 0.6924                   | 1.3450 | 1.7613 | 2.1448  | 2.6245  | 2.9768  |
| 15                 | 0.6912                   | 1.3406 | 1.7531 | 2.1315  | 2.6025  | 2.9467  |
| 16                 | 0.6901                   | 1.3368 | 1.7459 | 2.1199  | 2.5835  | 2.9208  |
| 17                 | 0.6892                   | 1.3334 | 1.7396 | 2.1098  | 2.5669  | 2.8982  |
| 18                 | 0.6884                   | 1.3304 | 1.7341 | 2.1009  | 2.5524  | 2.8784  |
| 19                 | 0.6876                   | 1.3277 | 1.7291 | 2.0930  | 2.5395  | 2.8609  |
| 20                 | 0.6870                   | 1.3253 | 1.7247 | 2.0860  | 2.5280  | 2.8453  |
| 21                 | 0.6864                   | 1.3232 | 1.7207 | 2.0796  | 2.5177  | 2.8314  |
| 22                 | 0.6858                   | 1.3212 | 1.7171 | 2.0739  | 2.5083  | 2.8188  |
| 23                 | 0.6853                   | 1.3195 | 1.7139 | 2.0687  | 2.4999  | 2.8073  |
| 24                 | 0.6848                   | 1.3178 | 1.7109 | 2.0639  | 2.4922  | 2.7969  |
| 25                 | 0.6844                   | 1.3163 | 1.7081 | 2.0595  | 2.4851  | 2.7874  |
| 26                 | 0.6840                   | 1.3150 | 1.7056 | 2.0555  | 2.4786  | 2.7787  |
| 27                 | 0.6837                   | 1.3137 | 1.7033 | 2.0518  | 2.4727  | 2.7707  |
| 28                 | 0.6834                   | 1.3125 | 1.7011 | 2.0484  | 2.4671  | 2.7633  |
| 29                 | 0.6830                   | 1.3114 | 1.6991 | 2.0452  | 2.4620  | 2.7564  |
| 30                 | 0.6828                   | 1.3104 | 1.6973 | 2.0423  | 2.4573  | 2.7500  |
| 31                 | 0.6825                   | 1.3095 | 1.6955 | 2.0395  | 2.4528  | 2.7440  |
| 32                 | 0.6822                   | 1.3086 | 1.6939 | 2.0369  | 2.4487  | 2.7385  |
| 33                 | 0.6820                   | 1.3077 | 1.6924 | 2.0345  | 2.4448  | 2.7333  |
| 34                 | 0.6818                   | 1.3070 | 1.6909 | 2.0322  | 2.4411  | 2.7284  |
| 35                 | 0.6816                   | 1.3062 | 1.6896 | 2.0301  | 2.4377  | 2.7238  |
| 36                 | 0.6814                   | 1.3055 | 1.6883 | 2.0281  | 2.4345  | 2.7195  |
| 37                 | 0.6812                   | 1.3049 | 1.6871 | 2.0262  | 2.4314  | 2.7154  |
| 38                 | 0.6810                   | 1.3042 | 1.6860 | 2.0244  | 2.4286  | 2.7116  |
| 39                 | 0.6808                   | 1.3036 | 1.6849 | 2.0227  | 2.4258  | 2.7079  |
| 40                 | 0.6807                   | 1.3031 | 1.6839 | 2.0211  | 2.4233  | 2.7045  |
| 41                 | 0.6805                   | 1.3025 | 1.6829 | 2.0195  | 2.4208  | 2.7012  |
| 42                 | 0.6804                   | 1.3020 | 1.6820 | 2.0181  | 2.4185  | 2.6981  |
| 43                 | 0.6802                   | 1.3016 | 1.6811 | 2.0167  | 2.4163  | 2.6951  |
| 44                 | 0.6801                   | 1.3011 | 1.6802 | 2.0154  | 2.4141  | 2.6923  |
| 45                 | 0.6800                   | 1.3006 | 1.6794 | 2.0141  | 2.4121  | 2.6896  |
| 46                 | 0.6799                   | 1.3002 | 1.6787 | 2.0129  | 2.4102  | 2.6870  |
| 47                 | 0.6797                   | 1.2998 | 1.6779 | 2.0117  | 2.4083  | 2.6846  |
| 48                 | 0.6796                   | 1.2994 | 1.6772 | 2.0106  | 2.4066  | 2.6822  |
| 49                 | 0.6795                   | 1.2991 | 1.6766 | 2.0096  | 2.4049  | 2.6800  |
| 50                 | 0.6794                   | 1.2987 | 1.6759 | 2.0086  | 2.4033  | 2.6778  |

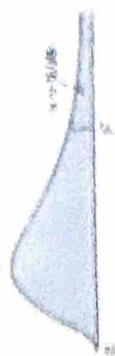


TABLE B.3

Critical Values of  $t$  (continued)For a particular number of degrees of freedom, entry represents the critical value of  $t$  corresponding to the cumulative probability  $(1 - \alpha)$  and a specified upper-tail area  $(\alpha)$ .

| Degrees of Freedom | Cumulative Probabilities |        |        |        |        |        |
|--------------------|--------------------------|--------|--------|--------|--------|--------|
|                    | 0.75                     | 0.90   | 0.95   | 0.975  | 0.99   | 0.995  |
|                    | Upper-Tail Areas         |        |        |        |        |        |
|                    | 0.25                     | 0.10   | 0.05   | 0.025  | 0.01   | 0.005  |
| 51                 | 0.6793                   | 1.2984 | 1.6783 | 2.0076 | 2.4017 | 2.6757 |
| 52                 | 0.6792                   | 1.2980 | 1.6747 | 2.0066 | 2.4002 | 2.6737 |
| 53                 | 0.6791                   | 1.2977 | 1.6741 | 2.0057 | 2.3988 | 2.6718 |
| 54                 | 0.6791                   | 1.2974 | 1.6736 | 2.0049 | 2.3974 | 2.6700 |
| 55                 | 0.6790                   | 1.2971 | 1.6730 | 2.0040 | 2.3961 | 2.6682 |
| 56                 | 0.6789                   | 1.2969 | 1.6725 | 2.0032 | 2.3948 | 2.6665 |
| 57                 | 0.6788                   | 1.2966 | 1.6720 | 2.0025 | 2.3936 | 2.6649 |
| 58                 | 0.6787                   | 1.2963 | 1.6716 | 2.0017 | 2.3924 | 2.6633 |
| 59                 | 0.6787                   | 1.2961 | 1.6711 | 2.0010 | 2.3912 | 2.6618 |
| 60                 | 0.6786                   | 1.2958 | 1.6706 | 2.0003 | 2.3901 | 2.6603 |
| 61                 | 0.6785                   | 1.2956 | 1.6702 | 1.9996 | 2.3890 | 2.6589 |
| 62                 | 0.6785                   | 1.2954 | 1.6698 | 1.9990 | 2.3880 | 2.6575 |
| 63                 | 0.6784                   | 1.2951 | 1.6694 | 1.9983 | 2.3870 | 2.6561 |
| 64                 | 0.6783                   | 1.2949 | 1.6690 | 1.9977 | 2.3860 | 2.6549 |
| 65                 | 0.6783                   | 1.2947 | 1.6686 | 1.9971 | 2.3851 | 2.6536 |
| 66                 | 0.6782                   | 1.2945 | 1.6683 | 1.9966 | 2.3842 | 2.6524 |
| 67                 | 0.6782                   | 1.2943 | 1.6679 | 1.9960 | 2.3833 | 2.6512 |
| 68                 | 0.6781                   | 1.2941 | 1.6676 | 1.9955 | 2.3824 | 2.6501 |
| 69                 | 0.6781                   | 1.2939 | 1.6672 | 1.9949 | 2.3816 | 2.6490 |
| 70                 | 0.6780                   | 1.2938 | 1.6669 | 1.9944 | 2.3808 | 2.6479 |
| 71                 | 0.6780                   | 1.2936 | 1.6666 | 1.9939 | 2.3800 | 2.6469 |
| 72                 | 0.6779                   | 1.2934 | 1.6663 | 1.9935 | 2.3793 | 2.6459 |
| 73                 | 0.6779                   | 1.2933 | 1.6660 | 1.9930 | 2.3785 | 2.6449 |
| 74                 | 0.6778                   | 1.2931 | 1.6657 | 1.9925 | 2.3778 | 2.6439 |
| 75                 | 0.6778                   | 1.2929 | 1.6654 | 1.9921 | 2.3771 | 2.6430 |
| 76                 | 0.6777                   | 1.2928 | 1.6652 | 1.9917 | 2.3764 | 2.6421 |
| 77                 | 0.6777                   | 1.2926 | 1.6649 | 1.9913 | 2.3758 | 2.6412 |
| 78                 | 0.6776                   | 1.2925 | 1.6646 | 1.9908 | 2.3751 | 2.6403 |
| 79                 | 0.6776                   | 1.2924 | 1.6644 | 1.9905 | 2.3745 | 2.6395 |
| 80                 | 0.6776                   | 1.2922 | 1.6641 | 1.9901 | 2.3739 | 2.6387 |
| 81                 | 0.6775                   | 1.2921 | 1.6639 | 1.9897 | 2.3733 | 2.6379 |
| 82                 | 0.6775                   | 1.2920 | 1.6636 | 1.9893 | 2.3727 | 2.6371 |
| 83                 | 0.6775                   | 1.2918 | 1.6634 | 1.9890 | 2.3721 | 2.6364 |
| 84                 | 0.6774                   | 1.2917 | 1.6632 | 1.9886 | 2.3716 | 2.6356 |
| 85                 | 0.6774                   | 1.2916 | 1.6630 | 1.9883 | 2.3710 | 2.6349 |
| 86                 | 0.6774                   | 1.2915 | 1.6628 | 1.9879 | 2.3705 | 2.6342 |
| 87                 | 0.6773                   | 1.2914 | 1.6626 | 1.9876 | 2.3700 | 2.6335 |
| 88                 | 0.6773                   | 1.2912 | 1.6624 | 1.9873 | 2.3695 | 2.6329 |
| 89                 | 0.6773                   | 1.2911 | 1.6622 | 1.9870 | 2.3690 | 2.6322 |
| 90                 | 0.6772                   | 1.2910 | 1.6620 | 1.9867 | 2.3685 | 2.6316 |
| 91                 | 0.6772                   | 1.2909 | 1.6618 | 1.9864 | 2.3680 | 2.6309 |
| 92                 | 0.6772                   | 1.2908 | 1.6616 | 1.9861 | 2.3676 | 2.6303 |
| 93                 | 0.6771                   | 1.2907 | 1.6614 | 1.9858 | 2.3671 | 2.6297 |
| 94                 | 0.6771                   | 1.2906 | 1.6612 | 1.9855 | 2.3667 | 2.6291 |
| 95                 | 0.6771                   | 1.2905 | 1.6611 | 1.9853 | 2.3662 | 2.6286 |
| 96                 | 0.6771                   | 1.2904 | 1.6609 | 1.9850 | 2.3658 | 2.6280 |
| 97                 | 0.6770                   | 1.2903 | 1.6607 | 1.9847 | 2.3654 | 2.6275 |
| 98                 | 0.6770                   | 1.2902 | 1.6606 | 1.9845 | 2.3650 | 2.6269 |
| 99                 | 0.6770                   | 1.2902 | 1.6604 | 1.9842 | 2.3646 | 2.6264 |
| 100                | 0.6770                   | 1.2901 | 1.6602 | 1.9840 | 2.3642 | 2.6259 |
| 110                | 0.6767                   | 1.2893 | 1.6588 | 1.9818 | 2.3607 | 2.6213 |
| 120                | 0.6765                   | 1.2886 | 1.6577 | 1.9799 | 2.3578 | 2.6174 |
| ∞                  | 0.6745                   | 1.2816 | 1.6449 | 1.9600 | 2.3263 | 2.5758 |

P.T.O.



**TABLE E.5**  
Critical Values of F

For a particular combination of numerator and denominator degrees of freedom, entry represents the critical values of F corresponding to the cumulative probability (1 -  $\alpha$ ) and a specified upper tail area ( $\alpha$ ).

Cumulative Probabilities in 1965

Upper Tail Areas in 1965

Source: 46

| Denominator | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     | 12     | 15     | 20     | 25     | 30     | 40     | 50     | 60     | 70     | 80     | 90     | 100    | 120    | 140    | 160    | 180    | 200    | 250    | 300    | 400    | 500    | 600    | 700    | 800    | 900    | 1000   |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |     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       |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |   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|         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |          |
|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------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| 1           | 162.40 | 198.50 | 205.70 | 206.60 | 208.20 | 209.00 | 210.30 | 210.80 | 211.70 | 212.10 | 213.10 | 214.00 | 215.00 | 216.00 | 217.00 | 218.00 | 219.00 | 220.00 | 221.00 | 222.00 | 223.00 | 224.00 | 225.00 | 226.00 | 227.00 | 228.00 | 229.00 | 230.00 | 231.00 | 232.00 | 233.00 | 234.00 | 235.00 | 236.00 | 237.00 | 238.00 | 239.00 | 240.00 | 241.00 | 242.00 | 243.00 | 244.00 | 245.00 | 246.00 | 247.00 | 248.00 | 249.00 | 250.00 | 251.00 | 252.00 | 253.00 | 254.00 | 255.00 | 256.00 | 257.00 | 258.00 | 259.00 | 260.00 | 261.00 | 262.00 | 263.00 | 264.00 | 265.00 | 266.00 | 267.00 | 268.00 | 269.00 | 270.00 | 271.00 | 272.00 | 273.00 | 274.00 | 275.00 | 276.00 | 277.00 | 278.00 | 279.00 | 280.00 | 281.00 | 282.00 | 283.00 | 284.00 | 285.00 | 286.00 | 287.00 | 288.00 | 289.00 | 290.00 | 291.00 | 292.00 | 293.00 | 294.00 | 295.00 | 296.00 | 297.00 | 298.00 | 299.00 | 300.00 | 301.00 | 302.00 | 303.00 | 304.00 | 305.00 | 306.00 | 307.00 | 308.00 | 309.00 | 310.00 | 311.00 | 312.00 | 313.00 | 314.00 | 315.00 | 316.00 | 317.00 | 318.00 | 319.00 | 320.00 | 321.00 | 322.00 | 323.00 | 324.00 | 325.00 | 326.00 | 327.00 | 328.00 | 329.00 | 330.00 | 331.00 | 332.00 | 333.00 | 334.00 | 335.00 | 336.00 | 337.00 | 338.00 | 339.00 | 340.00 | 341.00 | 342.00 | 343.00 | 344.00 | 345.00 | 346.00 | 347.00 | 348.00 | 349.00 | 350.00 | 351.00 | 352.00 | 353.00 | 354.00 | 355.00 | 356.00 | 357.00 | 358.00 | 359.00 | 360.00 | 361.00 | 362.00 | 363.00 | 364.00 | 365.00 | 366.00 | 367.00 | 368.00 | 369.00 | 370.00 | 371.00 | 372.00 | 373.00 | 374.00 | 375.00 | 376.00 | 377.00 | 378.00 | 379.00 | 380.00 | 381.00 | 382.00 | 383.00 | 384.00 | 385.00 | 386.00 | 387.00 | 388.00 | 389.00 | 390.00 | 391.00 | 392.00 | 393.00 | 394.00 | 395.00 | 396.00 | 397.00 | 398.00 | 399.00 | 400.00 | 401.00 | 402.00 | 403.00 | 404.00 | 405.00 | 406.00 | 407.00 | 408.00 | 409.00 | 410.00 | 411.00 | 412.00 | 413.00 | 414.00 | 415.00 | 416.00 | 417.00 | 418.00 | 419.00 | 420.00 | 421.00 | 422.00 | 423.00 | 424.00 | 425.00 | 426.00 | 427.00 | 428.00 | 429.00 | 430.00 | 431.00 | 432.00 | 433.00 | 434.00 | 435.00 | 436.00 | 437.00 | 438.00 | 439.00 | 440.00 | 441.00 | 442.00 | 443.00 | 444.00 | 445.00 | 446.00 | 447.00 | 448.00 | 449.00 | 450.00 | 451.00 | 452.00 | 453.00 | 454.00 | 455.00 | 456.00 | 457.00 | 458.00 | 459.00 | 460.00 | 461.00 | 462.00 | 463.00 | 464.00 | 465.00 | 466.00 | 467.00 | 468.00 | 469.00 | 470.00 | 471.00 | 472.00 | 473.00 | 474.00 | 475.00 | 476.00 | 477.00 | 478.00 | 479.00 | 480.00 | 481.00 | 482.00 | 483.00 | 484.00 | 485.00 | 486.00 | 487.00 | 488.00 | 489.00 | 490.00 | 491.00 | 492.00 | 493.00 | 494.00 | 495.00 | 496.00 | 497.00 | 498.00 | 499.00 | 500.00 | 501.00 | 502.00 | 503.00 | 504.00 | 505.00 | 506.00 | 507.00 | 508.00 | 509.00 | 510.00 | 511.00 | 512.00 | 513.00 | 514.00 | 515.00 | 516.00 | 517.00 | 518.00 | 519.00 | 520.00 | 521.00 | 522.00 | 523.00 | 524.00 | 525.00 | 526.00 | 527.00 | 528.00 | 529.00 | 530.00 | 531.00 | 532.00 | 533.00 | 534.00 | 535.00 | 536.00 | 537.00 | 538.00 | 539.00 | 540.00 | 541.00 | 542.00 | 543.00 | 544.00 | 545.00 | 546.00 | 547.00 | 548.00 | 549.00 | 550.00 | 551.00 | 552.00 | 553.00 | 554.00 | 555.00 | 556.00 | 557.00 | 558.00 | 559.00 | 560.00 | 561.00 | 562.00 | 563.00 | 564.00 | 565.00 | 566.00 | 567.00 | 568.00 | 569.00 | 570.00 | 571.00 | 572.00 | 573.00 | 574.00 | 575.00 | 576.00 | 577.00 | 578.00 | 579.00 | 580.00 | 581.00 | 582.00 | 583.00 | 584.00 | 585.00 | 586.00 | 587.00 | 588.00 | 589.00 | 590.00 | 591.00 | 592.00 | 593.00 | 594.00 | 595.00 | 596.00 | 597.00 | 598.00 | 599.00 | 600.00 | 601.00 | 602.00 | 603.00 | 604.00 | 605.00 | 606.00 | 607.00 | 608.00 | 609.00 | 610.00 | 611.00 | 612.00 | 613.00 | 614.00 | 615.00 | 616.00 | 617.00 | 618.00 | 619.00 | 620.00 | 621.00 | 622.00 | 623.00 | 624.00 | 625.00 | 626.00 | 627.00 | 628.00 | 629.00 | 630.00 | 631.00 | 632.00 | 633.00 | 634.00 | 635.00 | 636.00 | 637.00 | 638.00 | 639.00 | 640.00 | 641.00 | 642.00 | 643.00 | 644.00 | 645.00 | 646.00 | 647.00 | 648.00 | 649.00 | 650.00 | 651.00 | 652.00 | 653.00 | 654.00 | 655.00 | 656.00 | 657.00 | 658.00 | 659.00 | 660.00 | 661.00 | 662.00 | 663.00 | 664.00 | 665.00 | 666.00 | 667.00 | 668.00 | 669.00 | 670.00 | 671.00 | 672.00 | 673.00 | 674.00 | 675.00 | 676.00 | 677.00 | 678.00 | 679.00 | 680.00 | 681.00 | 682.00 | 683.00 | 684.00 | 685.00 | 686.00 | 687.00 | 688.00 | 689.00 | 690.00 | 691.00 | 692.00 | 693.00 | 694.00 | 695.00 | 696.00 | 697.00 | 698.00 | 699.00 | 700.00 | 701.00 | 702.00 | 703.00 | 704.00 | 705.00 | 706.00 | 707.00 | 708.00 | 709.00 | 710.00 | 711.00 | 712.00 | 713.00 | 714.00 | 715.00 | 716.00 | 717.00 | 718.00 | 719.00 | 720.00 | 721.00 | 722.00 | 723.00 | 724.00 | 725.00 | 726.00 | 727.00 | 728.00 | 729.00 | 730.00 | 731.00 | 732.00 | 733.00 | 734.00 | 735.00 | 736.00 | 737.00 | 738.00 | 739.00 | 740.00 | 741.00 | 742.00 | 743.00 | 744.00 | 745.00 | 746.00 | 747.00 | 748.00 | 749.00 | 750.00 | 751.00 | 752.00 | 753.00 | 754.00 | 755.00 | 756.00 | 757.00 | 758.00 | 759.00 | 760.00 | 761.00 | 762.00 | 763.00 | 764.00 | 765.00 | 766.00 | 767.00 | 768.00 | 769.00 | 770.00 | 771.00 | 772.00 | 773.00 | 774.00 | 775.00 | 776.00 | 777.00 | 778.00 | 779.00 | 780.00 | 781.00 | 782.00 | 783.00 | 784.00 | 785.00 | 786.00 | 787.00 | 788.00 | 789.00 | 790.00 | 791.00 | 792.00 | 793.00 | 794.00 | 795.00 | 796.00 | 797.00 | 798.00 | 799.00 | 800.00 | 801.00 | 802.00 | 803.00 | 804.00 | 805.00 | 806.00 | 807.00 | 808.00 | 809.00 | 810.00 | 811.00 | 812.00 | 813.00 | 814.00 | 815.00 | 816.00 | 817.00 | 818.00 | 819.00 | 820.00 | 821.00 | 822.00 | 823.00 | 824.00 | 825.00 | 826.00 | 827.00 | 828.00 | 829.00 | 830.00 | 831.00 | 832.00 | 833.00 | 834.00 | 835.00 | 836.00 | 837.00 | 838.00 | 839.00 | 840.00 | 841.00 | 842.00 | 843.00 | 844.00 | 845.00 | 846.00 | 847.00 | 848.00 | 849.00 | 850.00 | 851.00 | 852.00 | 853.00 | 854.00 | 855.00 | 856.00 | 857.00 | 858.00 | 859.00 | 860.00 | 861.00 | 862.00 | 863.00 | 864.00 | 865.00 | 866.00 | 867.00 | 868.00 | 869.00 | 870.00 | 871.00 | 872.00 | 873.00 | 874.00 | 875.00 | 876.00 | 877.00 | 878.00 | 879.00 | 880.00 | 881.00 | 882.00 | 883.00 | 884.00 | 885.00 | 886.00 | 887.00 | 888.00 | 889.00 | 890.00 | 891.00 | 892.00 | 893.00 | 894.00 | 895.00 | 896.00 | 897.00 | 898.00 | 899.00 | 900.00 | 901.00 | 902.00 | 903.00 | 904.00 | 905.00 | 906.00 | 907.00 | 908.00 | 909.00 | 910.00 | 911.00 | 912.00 | 913.00 | 914.00 | 915.00 | 916.00 | 917.00 | 918.00 | 919.00 | 920.00 | 921.00 | 922.00 | 923.00 | 924.00 | 925.00 | 926.00 | 927.00 | 928.00 | 929.00 | 930.00 | 931.00 | 932.00 | 933.00 | 934.00 | 935.00 | 936.00 | 937.00 | 938.00 | 939.00 | 940.00 | 941.00 | 942.00 | 943.00 | 944.00 | 945.00 | 946.00 | 947.00 | 948.00 | 949.00 | 950.00 | 951.00 | 952.00 | 953.00 | 954.00 | 955.00 | 956.00 | 957.00 | 958.00 | 959.00 | 960.00 | 961.00 | 962.00 | 963.00 | 964.00 | 965.00 | 966.00 | 967.00 | 968.00 | 969.00 | 970.00 | 971.00 | 972.00 | 973.00 | 974.00 | 975.00 | 976.00 | 977.00 | 978.00 | 979.00 | 980.00 | 981.00 | 982.00 | 983.00 | 984.00 | 985.00 | 986.00 | 987.00 | 988.00 | 989.00 | 990.00 | 991.00 | 992.00 | 993.00 | 994.00 | 995.00 | 996.00 | 997.00 | 998.00 | 999.00 | 1000.00 | 1001.00 | 1002.00 | 1003.00 | 1004.00 | 1005.00 | 1006.00 | 1007.00 | 1008.00 | 1009.00 | 1010.00 | 1011.00 | 1012.00 | 1013.00 | 1014.00 | 1015.00 | 1016.00 | 1017.00 | 1018.00 | 1019.00 | 1020.00 | 1021.00 | 1022.00 | 1023.00 | 1024.00 | 1025.00 | 1026.00 | 1027.00 | 1028.00 | 1029.00 | 1030.00 | 1031.00 | 1032.00 | 1033.00 | 1034.00 | 1035.00 | 1036.00 | 1037.00 | 1038.00 | 1039.00 | 1040.00 | 1041.00 | 1042.00 | 1043.00 | 1044.00 | 1045.00 | 1046.00 | 1047.00 | 1048.00 | 1049.00 | 1050.00 | 1051.00 | 1052.00 | 1053.00 | 1054.00 | 1055.00 | 1056.00 | 1057.00 | 1058.00 | 1059.00 | 1060.00 | 1061.00 | 1062.00 | 1063.00 | 1064.00 | 1065.00 | 1066.00 | 1067.00 | 1068.00 | 1069.00 | 1070.00 | 1071.00 | 1072.00 | 1073.00 | 1074.00 | 1075.00 | 1076.00 | 1077.00 | 1078.00 | 1079.00 | 1080.00 | 1081.00 | 1082.00 | 1083.00 | 1084.00 | 1085.00 | 1086.00 | 1087.00 | 1088.00 | 1089.00 | 1090.00 | 1091.00 | 1092.00 | 1093.00 | 1094.00 | 1095.00 | 1096.00 | 1097.00 | 1098.00 | 1099.00 | 1100.00 | 1101.00 | 1102.00 | 1103.00 | 1104.00 | 1105.00 | 1106.00 | 1107.00 | 1108.00 | 1109.00 | 1110.00 | 1111.00 | 1112.00 | 1113.00 | 1114.00 | 1115.00 | 1116.00 | 1117.00 | 1118.00 | 1119.00 | 1120.00 | 1121.00 | 1122.00 | 1123.00 | 1124.00 | 1125.00 | 1126.00 | 1127.00 | 1128.00 | 1129.00 | 1130.00 | 1131.00 | 1132.00 | 1133.00 | 1134.00 | 1135.00 | 1136.00 | 1137.00 | 1138.00 | 1139.00 | 1140.00 | 1141.00 | 1142.00 | 1143.00 | 1144.00 | 1145.00 | 1146.00 | 1147.00 | 1148.00 | 1149.00 | 1150.00 | 1151.00 | 1152.00 | 1153.00 | 1154.00 | 1155.00 | 1156.00 | 1157.00 | 1158.00 | 1159.00 | 1160.00 | 1161.00 | 1162.00 | 1163.00 | 1164.00 | 1165.00 | 1166.00 | 1167.00 | 1168.00 | 1169.00 | 1170.00 | 1171.00 | 1172.00 | 1173.00 | 1174.00 | 1175.00 | 1176.00 | 1177.00 | 1178.00 | 1179.00 | 1180.00 | 1181.00 | 1182.00 | 1183.00 | 1184.00 | 1185.00 | 1186.00 | 1187.00 | 1188.000 |





TABLE E.5

Critical Values of  $F$  (continued)For a particular combination of numerator and denominator degrees of freedom, entry represents the critical values of  $F$  corresponding to the cumulative probability  $(1 - \alpha)$  and a specified upper tail area ( $\alpha$ ).

| Cumulative Probabilities = 0.975 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |          |          |          |          |          |  |  |
|----------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|----------|--|--|
| Upper-Tail Areas = 0.025         |        |        |        |        |        |        |        |        |        |        |        |        |        |        |          |          |          |          |          |  |  |
| Numerator, $df_1$                |        |        |        |        |        |        |        |        |        |        |        |        |        |        |          |          |          |          |          |  |  |
| Denominator, $df_2$              | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     | 12     | 15     | 20     | 24     | 30       | 40       | 60       | 120      | $\infty$ |  |  |
| 1                                | 647.80 | 799.50 | 864.20 | 899.60 | 921.80 | 937.10 | 948.20 | 956.70 | 963.30 | 968.60 | 976.70 | 984.90 | 993.10 | 997.20 | 1,001.00 | 1,008.00 | 1,010.00 | 1,014.00 | 1,018.00 |  |  |
| 2                                | 38.51  | 39.00  | 39.17  | 39.25  | 39.30  | 39.33  | 39.36  | 39.39  | 39.40  | 39.41  | 39.43  | 39.45  | 39.46  | 39.46  | 39.46    | 39.47    | 39.48    | 39.49    | 39.50    |  |  |
| 3                                | 17.44  | 16.04  | 15.44  | 15.10  | 14.88  | 14.73  | 14.62  | 14.54  | 14.47  | 14.42  | 14.34  | 14.25  | 14.17  | 14.12  | 14.08    | 14.04    | 13.99    | 13.95    | 13.90    |  |  |
| 4                                | 12.22  | 10.65  | 9.98   | 9.60   | 9.36   | 9.20   | 9.07   | 8.98   | 8.90   | 8.84   | 8.75   | 8.66   | 8.56   | 8.51   | 8.46     | 8.41     | 8.36     | 8.31     | 8.26     |  |  |
| 5                                | 10.01  | 8.43   | 7.76   | 7.39   | 7.15   | 6.98   | 6.85   | 6.76   | 6.68   | 6.62   | 6.52   | 6.43   | 6.33   | 6.28   | 6.23     | 6.18     | 6.12     | 6.07     | 6.02     |  |  |
| 6                                | 8.81   | 7.26   | 6.60   | 6.23   | 5.99   | 5.82   | 5.70   | 5.60   | 5.52   | 5.46   | 5.37   | 5.27   | 5.17   | 5.12   | 5.07     | 5.01     | 4.96     | 4.90     | 4.85     |  |  |
| 7                                | 8.07   | 6.53   | 5.89   | 5.52   | 5.29   | 5.12   | 4.99   | 4.90   | 4.82   | 4.76   | 4.67   | 4.57   | 4.47   | 4.42   | 4.36     | 4.31     | 4.25     | 4.20     | 4.14     |  |  |
| 8                                | 7.57   | 6.06   | 5.42   | 5.05   | 4.82   | 4.65   | 4.53   | 4.43   | 4.36   | 4.30   | 4.20   | 4.10   | 4.00   | 3.95   | 3.89     | 3.84     | 3.78     | 3.73     | 3.67     |  |  |
| 9                                | 7.21   | 5.71   | 5.08   | 4.72   | 4.48   | 4.32   | 4.20   | 4.10   | 4.03   | 3.96   | 3.87   | 3.77   | 3.67   | 3.61   | 3.56     | 3.51     | 3.45     | 3.39     | 3.33     |  |  |
| 10                               | 6.94   | 5.46   | 4.83   | 4.47   | 4.24   | 4.07   | 3.95   | 3.85   | 3.78   | 3.72   | 3.62   | 3.52   | 3.42   | 3.37   | 3.31     | 3.26     | 3.20     | 3.14     | 3.08     |  |  |
| 11                               | 6.72   | 5.26   | 4.63   | 4.28   | 4.04   | 3.88   | 3.76   | 3.66   | 3.59   | 3.53   | 3.43   | 3.33   | 3.23   | 3.17   | 3.12     | 3.06     | 3.00     | 2.94     | 2.88     |  |  |
| 12                               | 6.55   | 5.10   | 4.47   | 4.12   | 3.89   | 3.73   | 3.61   | 3.51   | 3.44   | 3.37   | 3.28   | 3.18   | 3.08   | 3.02   | 2.96     | 2.91     | 2.85     | 2.79     | 2.72     |  |  |
| 13                               | 6.41   | 4.97   | 4.35   | 4.00   | 3.77   | 3.60   | 3.48   | 3.39   | 3.31   | 3.25   | 3.15   | 3.05   | 2.95   | 2.89   | 2.84     | 2.78     | 2.72     | 2.66     | 2.60     |  |  |
| 14                               | 6.30   | 4.86   | 4.24   | 3.89   | 3.66   | 3.50   | 3.38   | 3.29   | 3.21   | 3.15   | 3.05   | 2.95   | 2.85   | 2.79   | 2.73     | 2.67     | 2.61     | 2.55     | 2.49     |  |  |
| 15                               | 6.20   | 4.77   | 4.15   | 3.80   | 3.58   | 3.41   | 3.29   | 3.20   | 3.12   | 3.06   | 2.96   | 2.86   | 2.76   | 2.70   | 2.64     | 2.59     | 2.52     | 2.46     | 2.40     |  |  |
| 16                               | 6.12   | 4.69   | 4.08   | 3.73   | 3.50   | 3.34   | 3.22   | 3.12   | 3.05   | 2.99   | 2.89   | 2.79   | 2.68   | 2.62   | 2.57     | 2.51     | 2.45     | 2.38     | 2.32     |  |  |
| 17                               | 6.04   | 4.62   | 4.01   | 3.66   | 3.44   | 3.28   | 3.16   | 3.06   | 2.98   | 2.92   | 2.82   | 2.72   | 2.62   | 2.56   | 2.50     | 2.44     | 2.38     | 2.32     | 2.25     |  |  |
| 18                               | 5.98   | 4.56   | 3.95   | 3.61   | 3.38   | 3.22   | 3.10   | 3.01   | 2.93   | 2.87   | 2.77   | 2.67   | 2.57   | 2.51   | 2.44     | 2.38     | 2.32     | 2.26     | 2.19     |  |  |
| 19                               | 5.92   | 4.51   | 3.90   | 3.56   | 3.33   | 3.17   | 3.05   | 2.96   | 2.88   | 2.82   | 2.72   | 2.62   | 2.52   | 2.45   | 2.39     | 2.33     | 2.27     | 2.20     | 2.13     |  |  |
| 20                               | 5.87   | 4.46   | 3.86   | 3.51   | 3.29   | 3.13   | 3.01   | 2.91   | 2.84   | 2.77   | 2.68   | 2.57   | 2.46   | 2.41   | 2.35     | 2.29     | 2.22     | 2.16     | 2.09     |  |  |
| 21                               | 5.83   | 4.42   | 3.82   | 3.48   | 3.25   | 3.09   | 2.97   | 2.87   | 2.80   | 2.73   | 2.64   | 2.53   | 2.42   | 2.37   | 2.31     | 2.25     | 2.18     | 2.11     | 2.04     |  |  |
| 22                               | 5.79   | 4.38   | 3.78   | 3.44   | 3.22   | 3.05   | 2.93   | 2.84   | 2.76   | 2.69   | 2.60   | 2.50   | 2.39   | 2.33   | 2.27     | 2.21     | 2.14     | 2.08     | 2.00     |  |  |
| 23                               | 5.75   | 4.35   | 3.75   | 3.41   | 3.18   | 3.02   | 2.90   | 2.81   | 2.73   | 2.67   | 2.57   | 2.47   | 2.36   | 2.30   | 2.24     | 2.18     | 2.11     | 2.04     | 1.97     |  |  |
| 24                               | 5.72   | 4.32   | 3.72   | 3.38   | 3.15   | 2.99   | 2.87   | 2.78   | 2.70   | 2.64   | 2.54   | 2.44   | 2.33   | 2.27   | 2.21     | 2.15     | 2.08     | 2.01     | 1.94     |  |  |
| 25                               | 5.69   | 4.29   | 3.69   | 3.35   | 3.13   | 2.97   | 2.85   | 2.75   | 2.68   | 2.61   | 2.51   | 2.41   | 2.30   | 2.24   | 2.18     | 2.12     | 2.05     | 1.98     | 1.91     |  |  |
| 26                               | 5.66   | 4.27   | 3.67   | 3.33   | 3.10   | 2.94   | 2.82   | 2.73   | 2.65   | 2.59   | 2.49   | 2.39   | 2.28   | 2.22   | 2.16     | 2.09     | 2.03     | 1.95     | 1.88     |  |  |
| 27                               | 5.63   | 4.24   | 3.63   | 3.31   | 3.08   | 2.92   | 2.80   | 2.71   | 2.63   | 2.57   | 2.47   | 2.36   | 2.25   | 2.19   | 2.13     | 2.07     | 2.00     | 1.93     | 1.85     |  |  |
| 28                               | 5.61   | 4.22   | 3.61   | 3.29   | 3.06   | 2.90   | 2.78   | 2.69   | 2.61   | 2.55   | 2.45   | 2.34   | 2.23   | 2.17   | 2.11     | 2.05     | 1.98     | 1.91     | 1.83     |  |  |
| 29                               | 5.59   | 4.20   | 3.61   | 3.27   | 3.04   | 2.88   | 2.76   | 2.67   | 2.59   | 2.53   | 2.43   | 2.32   | 2.21   | 2.15   | 2.09     | 2.03     | 1.96     | 1.89     | 1.81     |  |  |
| 30                               | 5.57   | 4.18   | 3.59   | 3.25   | 3.03   | 2.87   | 2.75   | 2.65   | 2.57   | 2.51   | 2.41   | 2.31   | 2.20   | 2.14   | 2.07     | 2.01     | 1.94     | 1.87     | 1.79     |  |  |
| 40                               | 5.42   | 4.05   | 3.46   | 3.13   | 2.90   | 2.74   | 2.62   | 2.53   | 2.45   | 2.39   | 2.29   | 2.18   | 2.07   | 2.01   | 1.94     | 1.88     | 1.80     | 1.72     | 1.64     |  |  |
| 60                               | 5.29   | 3.93   | 3.34   | 3.01   | 2.79   | 2.63   | 2.51   | 2.41   | 2.33   | 2.27   | 2.17   | 2.06   | 1.94   | 1.88   | 1.82     | 1.74     | 1.67     | 1.58     | 1.48     |  |  |
| 120                              | 5.15   | 3.80   | 3.23   | 2.89   | 2.67   | 2.52   | 2.39   | 2.30   | 2.22   | 2.16   | 2.05   | 1.94   | 1.82   | 1.76   | 1.69     | 1.61     | 1.53     | 1.43     | 1.31     |  |  |
| $\infty$                         | 5.02   | 3.69   | 3.12   | 2.79   | 2.57   | 2.41   | 2.29   | 2.19   | 2.11   | 2.05   | 1.94   | 1.83   | 1.71   | 1.64   | 1.57     | 1.49     | 1.40     | 1.30     | 1.17     |  |  |

TABLE E.6

Critical Values of  $F$  (continued)

For a particular combination of numerator and denominator degrees of freedom, entry represents the critical values of  $F$  corresponding to the cumulative probability  $(1 - \alpha)$  and a specified upper tail area ( $\alpha$ ).

Cumulative Probability = 0.99

Upper Tail Area = 0.01

Numerator,  $df_1$ 

| Denominator, $df_2$ | 1        | 2        | 3        | 4        | 5        | 6        | 7        | 8        | 9        | 10       | 12       | 15       | 20       | 24       | 30       | 40       | 60       | 120      | $\infty$ |
|---------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1                   | 4,052.00 | 4,090.50 | 3,403.00 | 3,625.00 | 3,764.00 | 3,850.00 | 3,928.00 | 3,992.00 | 4,022.00 | 4,056.00 | 4,094.00 | 4,137.00 | 4,180.00 | 4,233.00 | 4,261.00 | 4,287.00 | 4,313.00 | 4,336.00 | 4,364.00 |
| 2                   | 98.50    | 99.00    | 90.17    | 90.25    | 90.30    | 90.33    | 90.36    | 90.37    | 90.38    | 90.40    | 90.42    | 90.43    | 90.44    | 90.46    | 90.47    | 90.47    | 90.48    | 90.49    | 90.50    |
| 3                   | 34.12    | 30.82    | 29.46    | 28.71    | 28.24    | 27.91    | 27.67    | 27.49    | 27.35    | 27.25    | 27.08    | 26.87    | 26.69    | 26.60    | 26.50    | 26.41    | 26.32    | 26.22    | 26.14    |
| 4                   | 21.20    | 18.00    | 16.69    | 15.98    | 15.52    | 15.21    | 14.98    | 14.80    | 14.66    | 14.55    | 14.37    | 14.17    | 14.03    | 13.93    | 13.84    | 13.75    | 13.65    | 13.56    | 13.46    |
| 5                   | 16.26    | 13.27    | 12.06    | 11.39    | 10.97    | 10.67    | 10.46    | 10.29    | 10.16    | 10.05    | 9.89     | 9.72     | 9.55     | 9.47     | 9.36     | 9.29     | 9.20     | 9.11     | 9.02     |
| 6                   | 13.75    | 10.92    | 9.78     | 9.15     | 8.75     | 8.47     | 8.26     | 8.10     | 7.98     | 7.87     | 7.72     | 7.56     | 7.40     | 7.31     | 7.23     | 7.14     | 7.06     | 6.97     | 6.88     |
| 7                   | 12.25    | 9.55     | 8.45     | 7.85     | 7.46     | 7.19     | 6.99     | 6.84     | 6.72     | 6.62     | 6.47     | 6.31     | 6.16     | 6.07     | 5.99     | 5.91     | 5.82     | 5.74     | 5.65     |
| 8                   | 11.26    | 8.63     | 7.59     | 7.01     | 6.63     | 6.37     | 6.18     | 6.03     | 5.91     | 5.81     | 5.67     | 5.52     | 5.36     | 5.28     | 5.20     | 5.12     | 5.03     | 4.95     | 4.86     |
| 9                   | 10.56    | 8.02     | 6.99     | 6.42     | 6.06     | 5.80     | 5.61     | 5.47     | 5.35     | 5.26     | 5.11     | 4.96     | 4.81     | 4.73     | 4.65     | 4.57     | 4.48     | 4.40     | 4.31     |
| 10                  | 10.04    | 7.56     | 6.53     | 5.99     | 5.64     | 5.39     | 5.20     | 5.06     | 4.94     | 4.85     | 4.71     | 4.56     | 4.41     | 4.33     | 4.25     | 4.17     | 4.08     | 4.00     | 3.91     |
| 11                  | 9.65     | 7.21     | 6.23     | 5.67     | 5.32     | 5.07     | 4.89     | 4.74     | 4.63     | 4.54     | 4.40     | 4.25     | 4.10     | 4.03     | 3.94     | 3.86     | 3.78     | 3.69     | 3.60     |
| 12                  | 9.33     | 6.93     | 5.95     | 5.41     | 5.06     | 4.82     | 4.64     | 4.50     | 4.39     | 4.30     | 4.16     | 4.01     | 3.86     | 3.79     | 3.70     | 3.62     | 3.54     | 3.45     | 3.36     |
| 13                  | 9.07     | 6.70     | 5.74     | 5.21     | 4.86     | 4.62     | 4.44     | 4.30     | 4.19     | 4.10     | 3.96     | 3.82     | 3.66     | 3.59     | 3.51     | 3.43     | 3.34     | 3.25     | 3.17     |
| 14                  | 8.86     | 6.51     | 5.56     | 5.04     | 4.69     | 4.46     | 4.28     | 4.14     | 4.03     | 3.94     | 3.80     | 3.67     | 3.52     | 3.45     | 3.36     | 3.27     | 3.18     | 3.09     | 3.00     |
| 15                  | 8.68     | 6.36     | 5.42     | 4.89     | 4.56     | 4.32     | 4.14     | 4.00     | 3.89     | 3.80     | 3.67     | 3.52     | 3.37     | 3.30     | 3.21     | 3.13     | 3.03     | 2.96     | 2.87     |
| 16                  | 8.53     | 6.23     | 5.29     | 4.77     | 4.44     | 4.20     | 4.03     | 3.89     | 3.78     | 3.69     | 3.55     | 3.41     | 3.26     | 3.19     | 3.10     | 3.02     | 2.93     | 2.84     | 2.75     |
| 17                  | 8.40     | 6.11     | 5.18     | 4.67     | 4.34     | 4.10     | 3.93     | 3.79     | 3.68     | 3.59     | 3.46     | 3.31     | 3.16     | 3.09     | 3.00     | 2.92     | 2.83     | 2.74     | 2.65     |
| 18                  | 8.29     | 6.01     | 5.09     | 4.58     | 4.25     | 4.01     | 3.84     | 3.71     | 3.60     | 3.51     | 3.37     | 3.23     | 3.08     | 3.01     | 2.92     | 2.84     | 2.75     | 2.66     | 2.57     |
| 19                  | 8.18     | 5.93     | 5.01     | 4.50     | 4.17     | 3.94     | 3.77     | 3.63     | 3.52     | 3.43     | 3.30     | 3.15     | 3.00     | 2.93     | 2.84     | 2.76     | 2.67     | 2.58     | 2.49     |
| 20                  | 8.10     | 5.85     | 4.94     | 4.43     | 4.10     | 3.87     | 3.70     | 3.56     | 3.46     | 3.37     | 3.23     | 3.09     | 2.94     | 2.86     | 2.78     | 2.69     | 2.61     | 2.52     | 2.43     |
| 21                  | 8.02     | 5.78     | 4.87     | 4.37     | 4.04     | 3.81     | 3.64     | 3.51     | 3.40     | 3.31     | 3.17     | 3.03     | 2.88     | 2.80     | 2.72     | 2.64     | 2.55     | 2.46     | 2.37     |
| 22                  | 7.95     | 5.72     | 4.82     | 4.31     | 3.99     | 3.76     | 3.59     | 3.45     | 3.35     | 3.26     | 3.12     | 2.98     | 2.83     | 2.75     | 2.67     | 2.58     | 2.50     | 2.41     | 2.32     |
| 23                  | 7.88     | 5.66     | 4.76     | 4.26     | 3.94     | 3.71     | 3.54     | 3.41     | 3.30     | 3.21     | 3.07     | 2.93     | 2.78     | 2.70     | 2.62     | 2.54     | 2.45     | 2.36     | 2.27     |
| 24                  | 7.82     | 5.61     | 4.72     | 4.22     | 3.90     | 3.67     | 3.50     | 3.36     | 3.26     | 3.17     | 3.03     | 2.89     | 2.74     | 2.66     | 2.58     | 2.49     | 2.40     | 2.31     | 2.22     |
| 25                  | 7.77     | 5.57     | 4.68     | 4.18     | 3.85     | 3.63     | 3.46     | 3.32     | 3.22     | 3.13     | 2.99     | 2.85     | 2.70     | 2.62     | 2.54     | 2.45     | 2.36     | 2.27     | 2.18     |
| 26                  | 7.72     | 5.53     | 4.64     | 4.14     | 3.82     | 3.59     | 3.42     | 3.29     | 3.18     | 3.09     | 2.96     | 2.81     | 2.66     | 2.58     | 2.50     | 2.42     | 2.33     | 2.24     | 2.15     |
| 27                  | 7.68     | 5.49     | 4.60     | 4.11     | 3.78     | 3.56     | 3.39     | 3.26     | 3.15     | 3.06     | 2.93     | 2.78     | 2.63     | 2.55     | 2.47     | 2.38     | 2.29     | 2.20     | 2.11     |
| 28                  | 7.64     | 5.45     | 4.57     | 4.07     | 3.75     | 3.53     | 3.36     | 3.23     | 3.12     | 3.03     | 2.90     | 2.75     | 2.60     | 2.52     | 2.44     | 2.35     | 2.26     | 2.17     | 2.08     |
| 29                  | 7.60     | 5.42     | 4.54     | 4.04     | 3.73     | 3.50     | 3.33     | 3.20     | 3.09     | 3.00     | 2.87     | 2.73     | 2.57     | 2.49     | 2.41     | 2.33     | 2.24     | 2.15     | 2.06     |
| 30                  | 7.56     | 5.39     | 4.51     | 4.02     | 3.70     | 3.47     | 3.30     | 3.17     | 3.07     | 2.98     | 2.84     | 2.70     | 2.55     | 2.47     | 2.39     | 2.30     | 2.21     | 2.12     | 2.03     |
| 40                  | 7.31     | 5.18     | 4.31     | 3.83     | 3.51     | 3.29     | 3.12     | 2.99     | 2.89     | 2.80     | 2.66     | 2.52     | 2.37     | 2.29     | 2.21     | 2.13     | 2.03     | 1.94     | 1.85     |
| 60                  | 7.08     | 4.98     | 4.13     | 3.65     | 3.34     | 3.12     | 2.95     | 2.82     | 2.73     | 2.63     | 2.50     | 2.35     | 2.20     | 2.12     | 2.04     | 1.96     | 1.86     | 1.77     | 1.68     |
| 120                 | 6.85     | 4.79     | 3.95     | 3.48     | 3.17     | 2.96     | 2.79     | 2.66     | 2.56     | 2.47     | 2.34     | 2.19     | 2.03     | 1.95     | 1.86     | 1.79     | 1.69     | 1.60     | 1.51     |
| $\infty$            | 6.63     | 4.61     | 3.78     | 3.32     | 3.02     | 2.80     | 2.64     | 2.51     | 2.41     | 2.32     | 2.18     | 2.04     | 1.88     | 1.79     | 1.70     | 1.61     | 1.51     | 1.42     | 1.33     |

(continued)





872

TABLE E.5

Critical Values of  $F$  (continued)  
For a particular combination of numerator and denominator degrees of freedom, entry represents the critical value of  $F$  corresponding to the cumulative probability  $(1 - \alpha)$  and a specified upper-tail area  $\alpha$ .

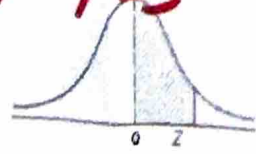
Cumulative Probabilities = 0.995  
Upper - Tail Areas = 0.005

| Denominator, $df_1$ | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     | 12     | 15     | 20     | 24     | 30     | 40     | 60     | 120    | $\infty$ |
|---------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|
| 1                   | 16.211 | 20.000 | 21.615 | 22.900 | 23.806 | 24.377 | 24.715 | 24.925 | 25.040 | 25.124 | 25.180 | 25.220 | 25.248 | 25.268 | 25.282 | 25.292 | 25.300 | 25.306 | 25.310   |
| 2                   | 198.50 | 199.00 | 199.20 | 199.30 | 199.40 | 199.50 | 199.60 | 199.70 | 199.80 | 199.90 | 200.00 | 200.10 | 200.20 | 200.30 | 200.40 | 200.50 | 200.60 | 200.70 | 200.80   |
| 3                   | 55.55  | 49.80  | 47.47  | 46.19  | 45.39  | 44.84  | 44.43  | 44.13  | 43.88  | 43.69  | 43.50  | 43.38  | 43.28  | 43.20  | 43.14  | 43.09  | 43.05  | 43.02  | 43.00    |
| 4                   | 31.33  | 26.28  | 24.26  | 23.15  | 22.46  | 21.97  | 21.62  | 21.35  | 21.14  | 20.97  | 20.80  | 20.69  | 20.61  | 20.54  | 20.49  | 20.45  | 20.42  | 20.40  | 20.38    |
| 5                   | 22.78  | 18.31  | 16.53  | 15.56  | 14.94  | 14.51  | 14.20  | 13.96  | 13.77  | 13.62  | 13.50  | 13.40  | 13.32  | 13.26  | 13.21  | 13.17  | 13.14  | 13.12  | 13.10    |
| 6                   | 18.63  | 14.54  | 12.92  | 12.08  | 11.46  | 11.07  | 10.79  | 10.57  | 10.39  | 10.25  | 10.13  | 10.03  | 9.95   | 9.87   | 9.82   | 9.78   | 9.75   | 9.73   | 9.71     |
| 7                   | 16.24  | 12.40  | 10.88  | 10.05  | 9.52   | 9.16   | 8.89   | 8.68   | 8.51   | 8.38   | 8.28   | 8.19   | 8.11   | 8.03   | 7.98   | 7.94   | 7.91   | 7.89   | 7.87     |
| 8                   | 14.69  | 11.04  | 9.60   | 8.81   | 8.30   | 7.95   | 7.69   | 7.50   | 7.34   | 7.21   | 7.10   | 7.01   | 6.93   | 6.85   | 6.80   | 6.76   | 6.73   | 6.71   | 6.69     |
| 9                   | 13.61  | 10.11  | 8.72   | 7.96   | 7.47   | 7.13   | 6.88   | 6.69   | 6.54   | 6.42   | 6.32   | 6.23   | 6.15   | 6.07   | 6.02   | 5.98   | 5.95   | 5.93   | 5.91     |
| 10                  | 12.83  | 9.43   | 8.08   | 7.34   | 6.87   | 6.54   | 6.30   | 6.12   | 5.97   | 5.85   | 5.76   | 5.67   | 5.59   | 5.51   | 5.46   | 5.42   | 5.39   | 5.37   | 5.35     |
| 11                  | 12.23  | 8.91   | 7.60   | 6.88   | 6.42   | 6.10   | 5.86   | 5.68   | 5.54   | 5.43   | 5.34   | 5.25   | 5.17   | 5.09   | 5.04   | 5.00   | 4.97   | 4.95   | 4.93     |
| 12                  | 11.75  | 8.51   | 7.23   | 6.52   | 6.07   | 5.76   | 5.52   | 5.35   | 5.20   | 5.09   | 4.99   | 4.90   | 4.82   | 4.74   | 4.69   | 4.65   | 4.62   | 4.60   | 4.58     |
| 13                  | 11.37  | 8.19   | 6.93   | 6.23   | 5.79   | 5.48   | 5.25   | 5.08   | 4.94   | 4.83   | 4.74   | 4.65   | 4.57   | 4.49   | 4.44   | 4.40   | 4.37   | 4.35   | 4.33     |
| 14                  | 11.06  | 7.92   | 6.68   | 6.00   | 5.56   | 5.26   | 5.03   | 4.86   | 4.72   | 4.60   | 4.51   | 4.42   | 4.34   | 4.26   | 4.21   | 4.17   | 4.14   | 4.12   | 4.10     |
| 15                  | 10.80  | 7.70   | 6.48   | 5.80   | 5.37   | 5.07   | 4.83   | 4.67   | 4.54   | 4.42   | 4.33   | 4.24   | 4.16   | 4.08   | 4.03   | 3.99   | 3.96   | 3.94   | 3.92     |
| 16                  | 10.58  | 7.51   | 6.30   | 5.64   | 5.21   | 4.91   | 4.67   | 4.52   | 4.38   | 4.27   | 4.18   | 4.09   | 4.01   | 3.93   | 3.88   | 3.84   | 3.81   | 3.79   | 3.77     |
| 17                  | 10.38  | 7.35   | 6.16   | 5.50   | 5.07   | 4.78   | 4.54   | 4.39   | 4.25   | 4.14   | 4.05   | 3.96   | 3.88   | 3.80   | 3.75   | 3.71   | 3.68   | 3.66   | 3.64     |
| 18                  | 10.22  | 7.21   | 6.03   | 5.37   | 4.96   | 4.66   | 4.42   | 4.28   | 4.14   | 4.03   | 3.94   | 3.86   | 3.78   | 3.70   | 3.65   | 3.61   | 3.58   | 3.56   | 3.54     |
| 19                  | 10.07  | 7.09   | 5.92   | 5.27   | 4.85   | 4.56   | 4.32   | 4.18   | 4.04   | 3.93   | 3.84   | 3.76   | 3.68   | 3.60   | 3.55   | 3.51   | 3.48   | 3.46   | 3.44     |
| 20                  | 9.94   | 6.99   | 5.82   | 5.17   | 4.76   | 4.47   | 4.23   | 4.09   | 3.96   | 3.85   | 3.76   | 3.68   | 3.60   | 3.52   | 3.47   | 3.43   | 3.40   | 3.38   | 3.36     |
| 21                  | 9.83   | 6.89   | 5.73   | 5.09   | 4.68   | 4.39   | 4.15   | 4.01   | 3.88   | 3.77   | 3.68   | 3.60   | 3.52   | 3.44   | 3.39   | 3.35   | 3.32   | 3.30   | 3.28     |
| 22                  | 9.73   | 6.81   | 5.65   | 5.02   | 4.61   | 4.32   | 4.08   | 3.94   | 3.81   | 3.70   | 3.61   | 3.53   | 3.45   | 3.37   | 3.32   | 3.28   | 3.25   | 3.23   | 3.21     |
| 23                  | 9.63   | 6.73   | 5.58   | 4.95   | 4.54   | 4.26   | 4.02   | 3.88   | 3.75   | 3.64   | 3.55   | 3.47   | 3.39   | 3.31   | 3.26   | 3.22   | 3.19   | 3.17   | 3.15     |
| 24                  | 9.55   | 6.66   | 5.52   | 4.89   | 4.49   | 4.20   | 3.96   | 3.83   | 3.69   | 3.59   | 3.50   | 3.42   | 3.34   | 3.26   | 3.21   | 3.17   | 3.14   | 3.12   | 3.10     |
| 25                  | 9.48   | 6.60   | 5.46   | 4.84   | 4.43   | 4.15   | 3.91   | 3.78   | 3.64   | 3.54   | 3.45   | 3.37   | 3.29   | 3.21   | 3.16   | 3.12   | 3.09   | 3.07   | 3.05     |
| 26                  | 9.41   | 6.54   | 5.41   | 4.79   | 4.38   | 4.10   | 3.86   | 3.73   | 3.60   | 3.49   | 3.40   | 3.32   | 3.24   | 3.16   | 3.11   | 3.07   | 3.04   | 3.02   | 3.00     |
| 27                  | 9.34   | 6.49   | 5.36   | 4.74   | 4.34   | 4.06   | 3.82   | 3.69   | 3.56   | 3.45   | 3.36   | 3.28   | 3.20   | 3.12   | 3.07   | 3.03   | 3.00   | 2.98   | 2.96     |
| 28                  | 9.28   | 6.44   | 5.32   | 4.70   | 4.30   | 4.02   | 3.78   | 3.65   | 3.52   | 3.41   | 3.32   | 3.24   | 3.16   | 3.08   | 3.03   | 3.00   | 2.97   | 2.95   | 2.93     |
| 29                  | 9.23   | 6.40   | 5.28   | 4.66   | 4.26   | 3.98   | 3.74   | 3.61   | 3.48   | 3.38   | 3.29   | 3.21   | 3.13   | 3.05   | 3.00   | 2.96   | 2.93   | 2.91   | 2.89     |
| 30                  | 9.18   | 6.35   | 5.24   | 4.62   | 4.23   | 3.95   | 3.71   | 3.58   | 3.45   | 3.34   | 3.25   | 3.17   | 3.09   | 3.01   | 2.96   | 2.92   | 2.89   | 2.87   | 2.85     |
| 40                  | 8.83   | 6.07   | 4.98   | 4.37   | 3.99   | 3.71   | 3.51   | 3.35   | 3.22   | 3.12   | 3.03   | 2.95   | 2.87   | 2.80   | 2.75   | 2.71   | 2.68   | 2.66   | 2.64     |
| 60                  | 8.40   | 5.79   | 4.71   | 4.14   | 3.76   | 3.49   | 3.29   | 3.13   | 3.01   | 2.90   | 2.81   | 2.73   | 2.65   | 2.58   | 2.53   | 2.49   | 2.46   | 2.44   | 2.42     |
| 120                 | 8.18   | 5.54   | 4.50   | 3.92   | 3.55   | 3.28   | 3.09   | 2.93   | 2.81   | 2.70   | 2.61   | 2.53   | 2.45   | 2.38   | 2.33   | 2.29   | 2.26   | 2.24   | 2.22     |
| $\infty$            | 7.88   | 5.30   | 4.28   | 3.72   | 3.35   | 3.09   | 2.90   | 2.74   | 2.62   | 2.52   | 2.43   | 2.35   | 2.27   | 2.20   | 2.15   | 2.11   | 2.08   | 2.06   | 2.04     |

TABLE E.10

The Standardized Normal Distribution

Entry represents area under the standardized normal distribution from the mean to Z



| Z   | .00   | .01   | .02   | .03   | .04   | .05   | .06   | .07   | .08   | .09   |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0.0 | .0000 | .0040 | .0080 | .0120 | .0160 | .0199 | .0239 | .0279 | .0319 | .0359 |
| 0.1 | .0398 | .0438 | .0478 | .0517 | .0557 | .0596 | .0636 | .0675 | .0714 | .0753 |
| 0.2 | .0793 | .0832 | .0871 | .0910 | .0948 | .0987 | .1026 | .1064 | .1103 | .1141 |
| 0.3 | .1179 | .1217 | .1255 | .1293 | .1331 | .1368 | .1406 | .1443 | .1480 | .1517 |
| 0.4 | .1554 | .1591 | .1628 | .1664 | .1700 | .1736 | .1772 | .1808 | .1844 | .1879 |
| 0.5 | .1915 | .1950 | .1985 | .2019 | .2054 | .2088 | .2123 | .2157 | .2190 | .2224 |
| 0.6 | .2257 | .2291 | .2324 | .2357 | .2389 | .2422 | .2454 | .2486 | .2518 | .2549 |
| 0.7 | .2580 | .2612 | .2642 | .2673 | .2704 | .2734 | .2764 | .2794 | .2823 | .2852 |
| 0.8 | .2881 | .2910 | .2939 | .2967 | .2995 | .3023 | .3051 | .3078 | .3106 | .3133 |
| 0.9 | .3159 | .3186 | .3212 | .3238 | .3264 | .3289 | .3315 | .3340 | .3365 | .3389 |
| 1.0 | .3413 | .3438 | .3461 | .3485 | .3508 | .3531 | .3554 | .3577 | .3599 | .3621 |
| 1.1 | .3643 | .3665 | .3686 | .3708 | .3729 | .3749 | .3770 | .3790 | .3810 | .3830 |
| 1.2 | .3849 | .3869 | .3888 | .3907 | .3925 | .3944 | .3962 | .3980 | .3997 | .4015 |
| 1.3 | .4032 | .4049 | .4066 | .4082 | .4099 | .4115 | .4131 | .4147 | .4162 | .4177 |
| 1.4 | .4192 | .4207 | .4222 | .4236 | .4251 | .4265 | .4279 | .4292 | .4306 | .4319 |
| 1.5 | .4332 | .4345 | .4357 | .4370 | .4382 | .4394 | .4406 | .4418 | .4429 | .4441 |
| 1.6 | .4452 | .4463 | .4474 | .4484 | .4495 | .4505 | .4515 | .4525 | .4535 | .4545 |
| 1.7 | .4554 | .4564 | .4573 | .4582 | .4591 | .4599 | .4608 | .4616 | .4625 | .4633 |
| 1.8 | .4641 | .4649 | .4656 | .4664 | .4671 | .4678 | .4686 | .4693 | .4699 | .4706 |
| 1.9 | .4713 | .4719 | .4726 | .4732 | .4738 | .4744 | .4750 | .4756 | .4761 | .4767 |
| 2.0 | .4772 | .4778 | .4783 | .4788 | .4793 | .4798 | .4803 | .4808 | .4812 | .4817 |
| 2.1 | .4821 | .4826 | .4830 | .4834 | .4838 | .4842 | .4846 | .4850 | .4854 | .4857 |
| 2.2 | .4861 | .4864 | .4868 | .4871 | .4875 | .4878 | .4881 | .4884 | .4887 | .4890 |
| 2.3 | .4893 | .4896 | .4898 | .4901 | .4904 | .4906 | .4909 | .4911 | .4913 | .4916 |
| 2.4 | .4918 | .4920 | .4922 | .4925 | .4927 | .4929 | .4931 | .4932 | .4934 | .4936 |
| 2.5 | .4938 | .4940 | .4941 | .4943 | .4945 | .4946 | .4948 | .4949 | .4951 | .4952 |
| 2.6 | .4953 | .4955 | .4956 | .4957 | .4959 | .4960 | .4961 | .4962 | .4963 | .4964 |
| 2.7 | .4965 | .4966 | .4967 | .4968 | .4969 | .4970 | .4971 | .4972 | .4973 | .4974 |
| 2.8 | .4974 | .4975 | .4976 | .4977 | .4977 | .4978 | .4979 | .4979 | .4980 | .4981 |
| 2.9 | .4981 | .4982 | .4982 | .4983 | .4984 | .4984 | .4985 | .4985 | .4986 | .4986 |
| 3.0 | .4986 | .4986 | .4987 | .4987 | .4988 | .4988 | .4988 | .4989 | .4989 | .4990 |
| 3.1 | .4990 | .4990 | .4991 | .4991 | .4991 | .4991 | .4992 | .4992 | .4992 | .4992 |
| 3.2 | .4993 | .4993 | .4993 | .4993 | .4994 | .4994 | .4994 | .4994 | .4994 | .4995 |
| 3.3 | .4995 | .4995 | .4995 | .4995 | .4995 | .4996 | .4996 | .4996 | .4996 | .4996 |
| 3.4 | .4996 | .4996 | .4996 | .4997 | .4997 | .4997 | .4997 | .4997 | .4997 | .4997 |
| 3.5 | .4997 | .4997 | .4997 | .4997 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 |
| 3.6 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 |
| 3.7 | .4998 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 |
| 3.8 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 |
| 3.9 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 |

(1000)



2  
[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5131

G

Unique Paper Code : 12033916

Name of the Paper : Applied Gender Studies:  
Media Literacies

Name of the Course : B.A. (Hons.) English - SEC

Semester : III/V

Duration : 3 Hours

Maximum Marks : 75

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Students with visual impairments may centre their answers on the non-visual elements of texts in the course.
3. **Part A and Part B** are both compulsory. Attempt any **Three** questions each from **Parts A and B** respectively.

P.T.O.

**Part A**

Attempt any 3 questions.

(3×10=30)

1. Comment on the importance of a critical analysis of structures of motherhood with the help of the prescribed essay by Nampally.
2. Is women's presence in public spaces an important measure of women's sense of freedom? Discuss with the help of any one prescribed text from the course.
3. Why do male characters get so much space even in "women-centric films"? Discuss with the help of any one film prescribed for study in the course.
4. Discuss, using examples from the prescribed poems by Meena Kandasamy, how patriarchal control over narratives can be challenged by creative texts.
5. Comment, with suitable examples, on how news media represents "women's issues" from contemporary society.



**Part B**

Attempt any 3 questions.

(3×15=45)

6. Does mainstream media coverage promote patriarchal and caste-based hierarchies? Analyse any two texts from your syllabus to discuss how critical media literacies can help undo oppressions.
7. Do films need to use heterosexuality to make themselves marketable? Give a reasoned answer with the help of prescribed films from the course.
8. Discuss with examples from the texts prescribed how the study of masculinities is an important part of efforts to change patriarchal values.
9. Conventional gender roles are very much part of the advertisements, be these matrimonial advertisements or advertising for commercial products. Discuss, using any of the texts prescribed in this course as well as advertisements you have encountered.

P.T.O.

10. Analyse any two documentary films from your course and comment on how their narratives are different from mainstream films.

(1500)

3  
[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5138

G

Unique Paper Code : 12053303

Name of the Paper : सोशल मीडिया

Name of the Course : B.A. (Hons.) Hindi (SEC)

Semester : III

Duration : 3 Hours

Maximum Marks : 75

छात्रों के लिए निर्देश

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए।

2. सभी प्रश्न अनिवार्य हैं।

1. सोशल मीडिया की अवधारणा स्पष्ट करते हुए इसके स्वरूप पर विचार कीजिए।

(12)

अथवा

सोशल मीडिया ने संस्कृति को कैसे प्रभावित किया है? स्पष्ट कीजिए।

2. जन जागरूकता को बढ़ाने में सोशल मीडिया की भूमिका का विवेचन कीजिए।

(12)

P.T.O.



अथवा

“सोशल मीडिया जनसंपर्क का एक सशक्त माध्यम बन चुका है।” इस कथन की समीक्षा कीजिए।

3. सोशल मीडिया ने व्यावसायिक प्रतिस्पर्धा को बढ़ाने में किस प्रकार की भूमिका निभायी है? विस्तार से समझाइए। (12)

अथवा

वर्तमान बाजारवादी युग के ब्रांड मेकिंग में सोशल मीडिया के योगदान पर विचार कीजिए।

4. सोशल मीडिया बालमन को कैसे प्रभावित करता है? सोदाहरण स्पष्ट कीजिए। (12)

अथवा

“सोशल मीडिया ने स्त्री को उपभोग की वस्तु में परिवर्तित करने का कार्य किया है।” इस कथन से आप कहाँ तक सहमत हैं? समीक्षा कीजिए।

5. किन्हीं तीन पर टिप्पणी लिखिए :

(क) सोशल मीडिया और बदलते सामाजिक मूल्य

(ख) ट्विटर और फेसबुक

(ग) सोशल मीडिया की आचार संहिता

(घ) सोशल मीडिया का युवाओं पर प्रभाव

(ङ) फेक न्यूज और सोशल मीडिया

(9×9×9=27)

(1000)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5531

G

Unique Paper Code : 12057505

Name of the Paper : Bhartiya Sahitya ki Sankshipt  
Ruprekha(SEC)

Name of the Course : B.A. (H) Hindi

Semester : V

Duration : 3 Hours

Maximum Marks : 75

छात्रों के लिए निर्देश

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए।

1. भारत की सांस्कृतिक विविधता का परिचय देते हुए उसके वैशिष्ट्य का विवेचन कीजिए। (12)

अथवा

भारतीय साहित्य की अवधारणा को स्पष्ट करते हुए उसकी विशेषताएँ बताइए।

2. वैदिक साहित्य को परिभाषित करते हुए उसकी प्रमुख विशेषताओं का वर्णन कीजिए। (12)

P.T.O.

अथवा

पालि साहित्य की विशेषताओं पर प्रकाश डालिए ।

3. आधुनिकता - पूर्व तमिल साहित्य अथवा तेलुगू साहित्य की मुख्य प्रवृत्तियों का वर्णन कीजिए । (12)

अथवा

मराठी साहित्य अथवा मलयालम साहित्य का सामान्य परिचय दीजिए ।

4. नवजागरण एवं राष्ट्रीय आंदोलन के संदर्भ में बांग्ला साहित्य का परिचय दीजिए । (12)

अथवा

भक्ति आंदोलन के संदर्भ में मराठी साहित्य की भूमिका का वर्णन कीजिए ।

5. किन्हीं तीन पर टिप्पणी लिखिए : (9×3=27)

(क) लौकिक साहित्य

(ख) बांग्ला साहित्य

(ग) आधुनिक भारतीय साहित्य की प्रमुख विशेषताएँ

(घ) स्वाधीनता आंदोलन और भारतीय साहित्य

(ङ) अखिल भारतीय भक्ति आंदोलन

(2000)



5  
[This question paper contains 4 printed pages.]

Your Roll No.....

आपका अनुक्रमांक.....

Sr. No. of Question Paper : 2523

G

Unique Paper Code : 2316000001

Name of the Paper : Museum and Museology Skill  
Enhancement Course

Name of the Course : Common Programme Group  
NEP: UGCF-UG

Semester/Annual : I/III

Duration : 1 Hours

Maximum Marks : 30

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any Two questions.
3. All questions carry equal marks.
4. Answers may be written either in English or Hindi; but the same medium should be used throughout the paper.

P.T.O.

Note: All fields as mentioned in the Performa are essential.

### छात्रों के लिए निर्देश

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए।
2. किन्हीं दो प्रश्नों के उत्तर दीजिये।
3. सभी प्रश्नों के अंक समान हैं।
4. इस प्रश्न-पत्र का उत्तर अंग्रेजी या हिंदी किसी एक भाषा में दीजिए, लेकिन सभी उत्तरों का माध्यम एक ही होना चाहिए।

नोट - प्रोफार्मा में उल्लिखित सभी फील्ड आवश्यक हैं।

1. Based on your research, give a historical account of the development of any one National Museum in India.

अपने शोध के आधार पर, भारत में किसी एक राष्ट्रीय संग्रहालय के विकास का ऐतिहासिक विवरण दें।

2. Discuss the Salient features of New Museology.

नवीन संग्रहालय विज्ञान की मुख्य विशेषताओं पर चर्चा करें।

3. Define Museum and discuss Its various functions

संग्रहालय को परिभाषित करें और इसके विभिन्न कार्यों पर चर्चा करें।

4. Short note: Attempt any two

(i) Colonial and Indian exhibition London 1886

1886 की औपनिवेशिक और भारतीय प्रदर्शनी, लंदन

(ii) Preventive Conservation

निवारक संरक्षण

(iii) Collection Policy

संग्रह नीति

P.T.O.



2523

4

(iv) Museum Exhibition

संग्रहालय प्रदर्शनी

(4000)

(6)  
[This question paper contains 4 printed pages.]

Your Roll No.....

आपका अनुक्रमांक.....

Sr. No. of Question Paper : 2553

G

Unique Paper Code : 2316000001

Name of the Paper : Museum and Museology  
Skill Enhancement Course

Name of the Course : Common Programme Group  
NEP: UGCF-UG

Semester/Annual : I/III

Duration : 1 Hours

Maximum Marks : 30

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any Two questions.
3. All questions carry equal marks.
4. Answers may be written either in English or Hindi; but the same medium should be used throughout the paper.

P.T.O.

Note: All fields as mentioned in the Performa are essential.

### छात्रों के लिए निर्देश

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए।
  2. किन्हीं दो प्रश्नों के उत्तर दीजिये।
  3. सभी प्रश्नों के अंक समान हैं।
  4. इस प्रश्न-पत्र का उत्तर अंग्रेजी या हिंदी किसी एक भाषा में दीजिए, लेकिन सभी उत्तरों का माध्यम एक ही होना चाहिए।
- नोट - प्रोफार्मा में उल्लिखित सभी फील्ड आवश्यक हैं।

1. Define Museum and its various functions.

संग्रहालय को परिभाषित करें तथा इसके विभिन्न भूमिकाओं पर चर्चा करें।

2. Discuss the Salient features of New Museology



नवीन संग्रहालय विज्ञान की विशेषताओं की चर्चा करें।

3. Discuss the nature of the collection and exhibition of a museum of your choice.

अपनी पसंद के संग्रहालय के संग्रह और प्रदर्शनी की प्रकृति पर चर्चा करें।

4. Short Note- any two

- (i) Preventive conservation

निवारक संरक्षण

- (ii) International Council of Museums (ICOM)

अंतर्राष्ट्रीय संग्रहालय परिषद (आईसीओएम)

- (iii) Colonial and Indian Exhibition London of 1886.

1886 में लंदन में औपनिवेशिक और भारतीय प्रदर्शनी।

P.T.O.

(iv) Collection policy

संग्रह नीति

(4000)

[This question paper contains 4 printed pages.]

Your Roll No.....

आपका अनुक्रमांक.....

Sr. No. of Question Paper : 2562

G

Unique Paper Code : 3206000001

Name of the Paper : Cyber Sphere and Security:  
Global Concerns

Name of the Course : Skill Enhancement Course  
[SEC]

पाठ्यक्रम का नाम : स्किल एनहांसमेंट कोर्स (एसईसी)

Semester / Annual : I/III

सेमेस्टर / वार्षिक

Duration : 1 Hours

Maximum Marks : 30

समय : 1 घण्टे

पूर्णांक : 30

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt Any Three questions.
3. All questions carry equal marks.

P.T.O.



4. Answers may be written either in English or Hindi; but the same medium should be used throughout the paper.

छात्रों के लिए निर्देश

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए ।
2. किन्हीं तीन प्रश्नों के उत्तर दीजिये ।
3. सभी प्रश्नों के अंक समान हैं ।
4. इस प्रश्न-पत्र का उत्तर अंग्रेजी या हिंदी किसी एक भाषा में दीजिए, लेकिन सभी उत्तरों का माध्यम एक ही होना चाहिए ।

1. Explain typologies of Cyber Crimes and their existence in digital era?

साइबर अपराध के प्रकार एवं डिजिटल युग में इसके अस्तित्व का वर्णन कीजिए ।

2. What do you understand by the term Cyber Security? Explain in brief its objectives and role.

साइबर सुरक्षा शब्द से आप क्या समझते हैं ? इसके उद्देश्यों एवं भूमिका की संक्षेप में व्याख्या कीजिए ।

3. What is Grey Area in Cyber Law? Explain the dimensions of Cyber Law.

साइबर लॉ में ग्रे एरिया क्या है ? साइबर कानून के आयामों की व्याख्या कीजिए ।

4. What is Risk Assessment in Cyber Security? Explain five things a risk assessment should include?

साइबर सुरक्षा में जोखिम मूल्यांकन क्या है ? जोखिम मूल्यांकन में शामिल होने वाली पांच चीजों की व्याख्या करें ?

5. "Cyber Security in banks and financial institutions are safest in the digital world". Comment.

"बैंकों और वित्तीय संस्थानों में साइबर सुरक्षा डिजिटल दुनिया में सबसे सुरक्षित है"। टिप्पणी कीजिए ।

6. What are the different categories of Cyber Criminals?  
Explain their modalities of operations.

साइबर अपराधियों की विभिन्न श्रेणियाँ क्या हैं ? साइबर अपराध करने  
की विभिन्न तकनीकों की व्याख्या कीजिए ।



[This question paper contains 4 printed pages.]

**Your Roll No.....**

**आपका अनुक्रमांक.....**

**Sr. No. of Question Paper : 2563**

**G**

**Unique Paper Code : 3206000002**

**Name of the Paper : Political Leadership and  
Communication**

**Name of the Course : Skill Enhancement Course  
[SEC]**

**पाठ्यक्रम का नाम : स्किल एनहांसमेंट कोर्स (एसईसी)**

**Semester / Annual : I/III**

**सेमेस्टर / वार्षिक**

**Duration : 1 Hours**

**Maximum Marks : 30**

**समय : 1 घण्टे**

**पूर्णांक : 30**

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **Any Three** questions.
3. All questions carry equal marks.

**P.T.O.**

4. Answers may be written either in English or Hindi; but the same medium should be used throughout the paper.

### छात्रों के लिए निर्देश

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए।
2. किन्हीं तीन प्रश्नों के उत्तर दीजिये।
3. सभी प्रश्नों के अंक समान हैं।
4. इस प्रश्न-पत्र का उत्तर अंग्रेजी या हिंदी किसी एक भाषा में दीजिए, लेकिन सभी उत्तरों का माध्यम एक ही होना चाहिए।

1. What is meant by Leadership? Discuss various theories of Leadership.

नेतृत्व से क्या अभिप्राय है ? नेतृत्व के विविध सिद्धांतों की विवेचना कीजिए।

2. Communication is an important skill of leadership. Discuss.

संप्रेषण नेतृत्व का एक महत्वपूर्ण कौशल है। विवेचना कीजिए।

3. Elaborate various sources of political communication.

राजनीतिक संचार के विभिन्न स्रोतों का वर्णन कीजिए।

4. Performance of Political Leadership is an important factor influencing political participation. Discuss.

राजनीतिक नेतृत्व का प्रदर्शन राजनीतिक सहभागिता को प्रभावित करने का महत्वपूर्ण कारक है। विवेचना कीजिए।

5. What do you understand by charismatic Political Leadership? On the basis of which qualities can a leadership be called charismatic leadership? Discuss.

करिश्माई राजनीतिक नेतृत्व से आप क्या समझते हैं? किन गुणों के आधार पर किसी नेतृत्व को करिश्माई नेतृत्व कहा जा सकता है? विवेचना कीजिए।



6. Psephology is an important method to study Political Communication. Discuss.

राजनीतिक संचार का अध्ययन करने हेतु चुनाव-विश्लेषण एक महत्वपूर्ण पद्धति है। विवेचना कीजिए।

9

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2584

G

Unique Paper Code : 2316000001

Name of the Paper : Museum and Museology

Name of the Course : **Common Programme  
Group NEP: UGCF-UG -  
Skill Enhancement Course  
(SEC)**

Semester : I / III

Duration : 1 Hour

Maximum Marks : 30

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **Two** questions.
3. **All** questions carry equal marks.
4. All fields as mentioned in the Performa are essential.
5. Answers may be written either in English or Hindi; but the same medium should be used throughout the paper.

P.T.O.

छात्रों के लिए निर्देश

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए।
2. किन्हीं दो प्रश्नों के उत्तर दीजिए।
3. सभी प्रश्नों के अंक समान हैं।
4. प्रोफार्मा में उल्लिखित सभी फील्ड आवश्यक हैं।
5. इस प्रश्न-पत्र का उत्तर अंग्रेजी या हिंदी किसी एक भाषा में दीजिए, लेकिन सभी उत्तरों का माध्यम एक ही होना चाहिए।

1. Define Museums and discuss its various types with examples.

संग्रहालयों को परिभाषित करें तथा उदाहरणों सहित उनके विभिन्न प्रकारों की चर्चा करें।

2. Discuss various functions of a Museums.



संग्रहालय के विभिन्न कार्यों की चर्चा कीजिए।

3. Discuss the salient features of New Museology.

नवीन संग्रहालय विज्ञान की विशेषताओं पर चर्चा करें।

4. Short note. Attempt any two.

संक्षिप्त टिप्पणी। कोई दो करें :

- (i) Preventive Conservation.

निवारक संरक्षण।

- (ii) Museum Exhibition.

संग्रहालय प्रदर्शनी।

- (iii) Colonial and Indian Exhibition of 1886,  
London.

1886 की औपनिवेशिक और भारतीय प्रदर्शनी, लंदन।

(iv) National Museum, New Delhi.

राष्ट्रीय संग्रहालय, नई दिल्ली ।

(10)  
[This question paper contains 4 printed pages.]

**Your Roll No.....**

**आपका अनुक्रमांक.....**

**Sr. No. of Question Paper : 2594**

**G**

**Unique Paper Code : 3206000002**

**Name of the Paper : Political Leadership and  
Communication**

**Name of the Course : Skill Enhancement Course  
[SEC]**

**पाठ्यक्रम का नाम : स्किल एनहांसमेंट कोर्स (एसईसी)**

**Semester / Annual : I/III**

**सेमेस्टर / वार्षिक**

**Duration : 1 Hours**

**Maximum Marks : 30**

**समय : 1 घण्टे**

**पूर्णांक : 30**

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt Any Three questions.
3. All questions carry equal marks.

**P.T.O.**



4. Answers may be written either in English or Hindi; but the same medium should be used throughout the paper.

### छात्रों के लिए निर्देश

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए ।
2. किन्हीं तीन प्रश्नों के उत्तर दीजिये ।
3. सभी प्रश्नों के अंक समान हैं ।
4. इस प्रश्न-पत्र का उत्तर अंग्रेजी या हिंदी किसी एक भाषा में दीजिए, लेकिन सभी उत्तरों का माध्यम एक ही होना चाहिए ।

1. Discuss theories of Political Leadership with relevant examples.

उपयुक्त उदाहरणों के साथ राजनीतिक नेतृत्व के सिद्धांतों की विवेचना कीजिए ।

2. Effective Political Communication is essential for strong Leadership. Elaborate.

सुषुप्त नेतृत्व हेतु प्रभावी राजनीतिक संप्रेषण अनिवार्य है। व्याख्या कीजिए।

3. What is Psephology? Discuss its importance in understanding voting behaviour.

चुनाव-विश्लेषण क्या है ? मत-व्यवहार को समझने में इसकी महत्ता की विवेचना कीजिए।

4. Political Communication has reoriented with the advent of technology in the era of Globalisation. Discuss.

वैश्वीकरण के युग में प्रौद्योगिकी के आगमन के साथ राजनीतिक संप्रेषण पुनरोन्मुख हुआ है। विवेचना कीजिए।

5. Psephology can be used as a tool for deepening democratic participation. Comment.

लोकतांत्रिक सहभागिता को गहन करने के लिए चुनाव-विश्लेषण का एक यंत्र की भाँति प्रयोग किया जा सकता है। टिप्पणी कीजिए।

6. Public Policy can be an effective tool of Political Communication. Discuss it with current examples.

लोक-नीति राजनीतिक संप्रेषण का एक प्रभावकारी उपकरण हो सकती है। समसामयिक उदाहरणों के साथ इसकी विवेचना कीजिए।

(11)  
[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2615

G

Unique Paper Code : 2316000001

Name of the Paper : Museum and Museology

Name of the Course : Common Programme  
Group NEP: UGCF-UG -  
Skill Enhancement Course  
(SEC)

Semester : I / III

Duration : 1 Hour

Maximum Marks : 30

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any Two questions.
3. All questions carry equal marks.
4. All fields as mentioned in the Performa are essential.
5. Answers may be written either in English or Hindi; but the same medium should be used throughout the paper.

P.T.O.



2615

प्राचीन के लिए निर्देश

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए।
2. किन्हीं दो प्रश्नों के उत्तर दीजिए।
3. सभी प्रश्नों के अंक समान हैं।
4. प्रोफार्मा में उल्लिखित सभी फील्ड आवश्यक हैं।
5. इस प्रश्न-पत्र का उत्तर अंग्रेजी या हिंदी किसी एक भाषा में दीजिए, लेकिन सभी उत्तरों का माध्यम एक ही होना चाहिए।

1. Discuss various approaches made to define Museum.

संग्रहालय को परिभाषित करने के लिए अपनाए गए विभिन्न दृष्टिकोणों पर चर्चा करें।

2. How do you understand the development of Museums as an institution in colonial India? Discuss with suitable examples.

अप्य औपनिवेशिक भारत में एक संस्था के रूप में संग्रहालय के विकास को कैसे समझते हैं? उपयुक्त उदाहरणों सहित चर्चा करें।

3. Elaborate on the salient features of New Museology.

नवीन संग्रहालय विज्ञान की प्रमुख विशेषताओं पर विस्तार से प्रकाश डालिए।

4. Attempt any two short-note :

किन्हीं दो पर संक्षिप्त टिप्पणी लिखें :

- (i) Types of Museum

संग्रहालय के प्रकार

- (ii) Factors of Deterioration in Museum objects

संग्रहालय की वस्तुओं के संरक्षण की चुनौतियाँ

(iii) Functions of a Museum

संग्रहालय के कार्य

(iv) Museum Exhibition

संग्रहालय प्रदर्शनी

(4000)

12  
[This question paper contains 2 printed pages.]

**Your Roll No.....**

**Sr. No. of Question Paper : 2622**

**G**

Unique Paper Code : 2036000003

Name of the Paper : Communication in Professional  
life (SOL)

Name of the Course : SEC

Semester : I

Duration : 2 Hours

Maximum Marks : 80

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. This question paper contains **SIX** questions. Candidates will attempt **ANY FOUR** questions.
3. **All** questions carry **20** marks each.

1. Define business communication and elaborate upon the seven C's of communication.
2. Discuss three potential barriers to effective communication in a diverse workplace and suggest strategies to overcome them.

P.T.O.



3. Write short notes on any **four** of the following :  
(5×4)
- (a) Netiquettes
  - (b) Note taking
  - (c) Summarising and Paraphrasing
  - (d) Stereotyping
  - (e) Group Discussion
  - (f) Social media posts
4. You are the publicity manager of an electronics manufacturing company. Your company had launched a new LED Tv three months ago. Write a report outlining the steps to boost the sale of this product.
5. You have been working as a Purchase Officer in a company. The company wants to purchase LED bulbs for its use. Write a letter to M/S Surya Lightings, enquiring about the LED bulbs.
6. You have read an advertisement in the Times of India, for the position of an accountant in a multinational company. Prepare a detailed CV for the same.

(12000)

[This question paper contains 2 printed pages.]

**Your Roll No.....**

**Sr. No. of Question Paper : 2629**

**G**

Unique Paper Code : 2036000005

Name of the Paper : NEP : UGCF2022 : SEC  
Personality and Development  
(SOL)

Name of the Course : **B.A. Programme/Hons**

Semester : I/III

Duration : 2 Hours

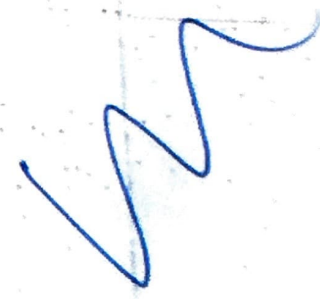
Maximum Marks : 80

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. This question paper contains **SIX** questions. Candidates will attempt **ANY FOUR** questions.
3. **All** questions carry **20** marks each.

1. What are the barriers to communication? Explain with the help of at least four examples.
2. Differentiate between Verbal and Non-Verbal Communication with the help of suitable examples.

P.T.O.

3. Prepare a questionnaire to survey the decision on odd-even transport drive by the Government to reduce pollution. It should have minimum ten questions and answers.
  4. Write a formal letter to the principal of your college seeking permission to hold a Students' Seminar in your college.
  5. Explain inter-cultural and cross-cultural communication. Give adequate examples.
  6. You want to sell an app you have developed that can be used by your friends/peers, explain promotional strategies you will use to do so.
- 

(14)  
[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2516

G

Unique Paper Code : 222600001

Name of the Paper : SEC – Radiation Safety

Name of the Course : B.Sc. (H) / B.Sc. (Prog.) –  
UGCF-NEP (SEC)

Semester : III

Duration : 1 Hour

Maximum Marks : 30

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt FIVE questions in all.
3. Question 1 is compulsory.
4. Each question carries SIX marks.
5. Use of scientific calculator is allowed.

P.T.O.



1. Attempt ANY SIX out of the following questions :  
(6×1=6)

(a) Bethe Bloch formula is used to calculate which quantity?

(b) Define range of an ionizing radiation.

(c) What is the SI unit of radioactivity?

(d) What is damaged in the human body during interaction with ionizing radiation?

(e) Define Annual Limit of Intake (ALI).

(f) The Geiger Muller counter CANNOT be used to detect\_\_\_\_\_of the radiation.

(g) Radiation therapy is widely used to treat which disease?

2. (a) Compare the penetrating power of alpha, beta and gamma rays having the same energy. (2)

(b) Show that the relation between half-life and decay

constant is given by  $T = \frac{0.693}{\lambda}$ . (4)

3. (a) How are neutrons used as moderators? (2)
- (b) Express the mathematical form of gamma ray photon interaction with matter. What are linear and mass attenuation coefficients? (4)
4. (a) Differentiate between equivalent dose and collective equivalent dose. (2)
- (b) What is the full form of KERMA? Explain its relevance in radiation safety. (4)
5. (a) Draw a schematic diagram of a semiconductor detector. (2)
- (b) Summarize the working of semiconductor detector for detection of radiation. (4)
6. (a) Give two examples of operational limits for working with radiation for men and women. (2)
- (b) What are the crucial biological effects of ionizing radiation? Explain briefly. (4)

P.T.O.

7. (a) Name any four application areas of nuclear radiation techniques.

(2)

(b) Discuss briefly one of the medical and one non-medical application.

(4)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2554

G

Unique Paper Code : 2316000002

Name of the Paper : Reading the Archive

Name of the Course : Skill Enhancement Course

Semester : III

Duration : 1 Hour

Maximum Marks : 30

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any two questions in all.
3. All questions carry equal marks.
4. Answers may be written either in English or Hindi; but the same medium should be used throughout the paper.

**छात्रों के लिए निर्देश**

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए।

P.T.O.



2. कुल दो प्रश्न करें।
3. सभी प्रश्नों के अंक समान हैं।
4. इस प्रश्न-पत्र का उत्तर अंग्रेजी या हिंदी किसी एक भाषा में दीजिए, लेकिन सभी उत्तरों का माध्यम एक ही होना चाहिए।

1. What is an Archive? Discuss its importance in the process of reconstruction of the past.

पुरालेख क्या है? अतीत के पुनर्निर्माण की प्रक्रिया में इसके महत्व पर चर्चा करें।

2. What is a census? Did it signify a simple way of enumeration or did it led to rise of identity politics in India during the British and the period thereafter.

जनगणना क्या है? क्या यह गणना के एक सरल तरीके को दर्शाता है या क्या इससे ब्रिटिश काल और उसके बाद की अवधि में भारत में पहचान की राजनीति का उदय हुआ?

3. The camera technology and related photographic medium emerged as a major development of the colonial rule. Elaborate.

कैमरा तकनीक और संबंधित फोटोग्राफिक माध्यम औपनिवेशिक शासन के एक प्रमुख विकास के रूप में उभरे। विस्तार में बताये।

4. Write short notes on **any two** of the following :

(a) Visual archives

(b) Memory as a tool of Power

(c) Nationalist writings and voice of Indigo cultivators

(d) Gendered nature of archives

निम्नलिखित में से किन्हीं दो विषयों पर संक्षिप्त नोट लिखें :

(क) दृश्य पुरालेख

(ख) शक्ति के एक उपकरण के रूप में स्मृति

(ग) राष्ट्रदारी लेखन और नील किसानों की आवाज

(घ) अभिलेखों की लिंग आधारित प्रकृति

15  
[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2628

G

Unique Paper Code : 2416000001

Name of the Paper : Business Communication

Name of the Course : Common Prog Group  
(SEC) UGCF BA (SOL)

Semester : III

Duration : 2 Hours

Maximum Marks : 60

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt all questions.
3. All questions carry equal marks.
4. Answers may be written either in English or Hindi; but the same medium should be used throughout the paper.

**छात्रों के लिए निर्देश**

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए।

P.T.O.



2628

2. सभी प्रश्नों के उत्तर दीजिये।
3. सभी प्रश्नों के अंक समान हैं।
4. इस प्रश्न-पत्र का उत्तर अंग्रेजी या हिंदी किसी एक भाषा में दीजिए, लेकिन सभी उत्तरों का माध्यम एक ही होना चाहिए।

1. (a) Communication has become all the more essential for the modern organizations today. Explain the statement in detail. (6)

(b) Describe the importance of upward communication in a business organization? (6)

OR

(a) Explain any five Socio-Psychological Barriers to effective Communication. (6)

(b) Describe the merits and demerits of informal communication channels to an organization. (6)

(अ) संचार आज आधुनिक संगठनों के लिए और भी आवश्यक हो गया है। कथन को विस्तार से समझाइये।

(ब) किसी व्यावसायिक संगठन में उर्ध्व संचार के महत्व का वर्णन कीजिए?

या

(अ) प्रभावी संचार में किन्हीं पांच सामाजिक-मनोवैज्ञानिक बाधाओं की व्याख्या कीजिए।

(ब) किसी संगठन में अनौपचारिक संचार चैनलों के गुण और दोषों का वर्णन कीजिए।

2. (a) Explain the role of library and internet in collection and classification of data. (6)

(b) Differentiate between citations; bibliography and references with the help of relevant examples. (6)

OR

P.T.O.

(a) Write a short note on consideration and courtesy with respect to effective writing. (6)

(b) What points should be kept in mind and precautions to be taken in preparing bibliography? (6)

(अ) डेटा के संग्रह और वर्गीकरण में पुस्तकालय और इंटरनेट की भूमिका की व्याख्या कीजिए।

(ब) प्रासंगिक उदाहरणों की सहायता से उद्धरणों; ग्रंथ सूची और संदर्भ के बीच अंतर कीजिए।

या

(अ) प्रभावी लेखन के संबंध में विचार और शिष्टाचार पर एक संक्षिप्त टिप्पणी लिखिए।

(ब) ग्रंथ सूची तैयार करते समय किन बातों को ध्यान में रखना चाहिए और क्या सावधानियां बरतनी चाहिए?

3. What is an Annual Report? What is the purpose of making an Annual Report? Elaborate on the contents of Annual Report? (2+2+8)

OR

Draft the minutes of a meeting of the Board of Directors where the following decisions were taken:

- (a) Appointment of Mr. Ram as Company Secretary
- (b) Purchase of Land and Building worth Rs. 10,00,000 and issue of equivalent shares to the supplier
- (c) Approval of Company's seal
- (d) Declaration of dividend of Rs. 10,000 (12)

वार्षिक रिपोर्ट क्या है? वार्षिक रिपोर्ट बनाने का उद्देश्य क्या है? वार्षिक रिपोर्ट की सामग्री के बारे में विस्तार से बताएं?

या

निदेशक मंडल की बैठक के कार्यवृत्त का मसौदा तैयार कीजिए जिसमें निम्नलिखित निर्णय लिए गए :

- (अ) कंपनी सचिव के रूप में श्री राम की नियुक्ति

P.T.O.



- (ब) 10,00,000 रुपये की भूमि और भवन की खरीद और आपूर्तिकर्ता के समकक्ष शेयर जारी करना
- (स) कंपनी की मुहर का अनुमोदन
- (द) 10,000 रुपये के लाभांश की घोषणा

4. Describe the role played by effective IT communication tools for business organizations today. Elaborate on the uses and merits of electronic mails.
- (6+6)

OR

Draft an office notice informing the employees of the organization of an International Conference on 'Global Leadership Practices' and detailing distribution of responsibilities.

(12)

आज व्यावसायिक संगठनों के लिए प्रभावी आईटी संचार उपकरणों द्वारा निभाई गई भूमिका का वर्णन कीजिए। इलेक्ट्रॉनिक मेल के उपयोग और गुणों पर विस्तार से चर्चा कीजिए।

या

‘वैश्विक नेतृत्व प्रथाओं’ पर एक अंतर्राष्ट्रीय सम्मेलन के संगठन के कर्मचारियों को सूचित करने और जिम्मेदारियों के वितरण का विवरण देने के लिए एक कार्यालय नोटिस का मसौदा तैयार कीजिए।

5. Explain the components of an effective presentation. What points should be taken into consideration for the proper organization of presentation. (8+4)

OR

It is often said that group decisions are more advantageous than individual decisions. Explain with reasons. Also, describe the steps of group decision making. (4+8)

एक प्रभावी प्रस्तुति के घटकों की व्याख्या कीजिए। प्रस्तुतिकरण के उचित आयोजन के लिए किन बिन्दुओं पर ध्यान देना चाहिए?

या

P.T.O.

अक्सर यह कहा जाता है कि व्यक्तिगत निर्णयों की तुलना में समूह के निर्णय अधिक लाभप्रद होते हैं। कारण सहित समझाइये। समूह निर्णय लेने के चरणों का भी वर्णन कीजिए।

16  
[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5824

G

Unique Paper Code : 62343319

Name of the Paper : PHP Programming (SEC)

Name of the Course : B.A. Prog. (CBCS-LOCF)

Semester : III

Duration : 2 Hours

Maximum Marks : 25

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Section A is compulsory (Question 1).
3. Attempt any three questions from Section B (Questions 2 to 6).

**SECTION A**

*Attempt all questions from this section.*

1. (a) List the differences between echo and print commands. (2)

P.T.O.



(b) For each of the variable name given below, determine whether it is valid or not?

- (i) lxyz
- (ii) \_rate\_of\_interest
- (iii) ab.12
- (iv) msg1\_len (2)

(c) Write the statement to define a PHP constant named RATE with value 0.05. (2)

(d) What will be the output of the following PHP command? (2)

`echo bin2hex("ABC");`

(e) Name the PHP functions used to remove unwanted whitespaces around a string. (2)

## SECTION B

(Any Three)

2. (a) Write the PHP code to define an associative array named 'exch\_rate' with data given below and then write the commands for the following : (3)

dollar = 75.98, pound = 89.31, euro = 82.14,  
franc = 77.6, aud = 45.02

- (i) Display the array in ascending order of values
- (ii) Display the array in descending order of the keys

- (b) What will be the output of the script given below? (2)

```
<?php
    $x = 2;
    while(TRUE)
    {
        print($x++);
        if($x>8)
            break;
    }
?>
```

3. (a) Given \$a = 10, \$b='10' and \$c='a'. Evaluate the following and justify your answers. (3)

- (i) \$a == \$b and \$a === \$b
- (ii) \$a != \$b and \$a !== \$b
- (iii) \$c and \$Sc

- (b) Determine the output of the code snippet given below. (2)

```
<?php
    $x=10;
    $y=15;
    if($x != $x++ || $y < $y++)
        echo "Executes ";
    echo $x, $y;
?>
```

4. (a) Write a PHP script to count the number of vowels in a string. (3)
- (b) Differentiate between implicit and explicit type casting. (2)
5. (a) Write a PHP script to define a one-dimensional array containing 10 integers. Using loops, calculate and display the sum of all odd and even numbers in this array. (4)
- (b) What will be the output of the PHP statement given below? (1)
- ```
$x = 13;  
echo $x < 12 ? "Hello" : "Bye";
```
6. (a) What will be the output of the PHP code given below? Justify your answer. (3)

```
<?php  
    $a = 100;  
    $b = 200;  
    echo 'a=$a';  
    echo "b=$b";  
?>
```

- (b) What are magic constants in PHP? Give any two examples. (2)

(1000)

7  
[This question paper contains 4 printed pages.]

**Your Roll No.....**

**Sr. No. of Question Paper : 5850**

**G**

Unique Paper Code : 62293305

Name of the Paper : Regional Planning and  
Sustainable Development

Name of the Course : **B.A. (Prog.) – Skill  
Enhancement Course  
(SEC) (LOCF) CBCS  
(Admission of 2019)**

Semester : III

Duration : 3 Hours

Maximum Marks : 75

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **All** questions are compulsory.
3. **All** questions carry equal marks.
4. Use of stencil is allowed for drawing outline of maps.
5. Answers may be written either in English or Hindi; but the same medium should be used throughout the paper.

P.T.O.



### छात्रों के लिए निर्देश

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए।
2. सभी प्रश्न अनिवार्य हैं।
3. सभी प्रश्नों के अंक समान हैं।
4. मानचित्रों की बाहरी रेखा खींचने के लिए स्टैसिल के प्रयोग की अनुमति है।
5. इस प्रश्न-पत्र का उत्तर अंग्रेजी या हिंदी किसी एक भाषा में दीजिए, लेकिन सभी उत्तरों का माध्यम एक ही होना चाहिए।

1. Discuss the various types of regional planning.

क्षेत्रीय नियोजन के विभिन्न प्रकारों की विवेचना कीजिए।

**OR / अथवा**

Discuss the concept of regional planning.

क्षेत्रीय नियोजन की अवधारणा की विवेचना कीजिए।

2. Analyze the various characteristics of an ideal planning region.

एक आदर्श नियोजन क्षेत्र की विभिन्न विशेषताओं का विश्लेषण कीजिए।

OR / अथवा

Discuss the various qualitative methods for delineation of a planning region.

नियोजन क्षेत्र के निर्धारण के लिए विभिन्न गुणात्मक विधियों की चर्चा कीजिए।

3. How is India regionalized on the basis of agro-ecological zones?

कृषि-पारिस्थितिक क्षेत्रों के आधार पर भारत का क्षेत्रीयकरण कैसे किया जाता है?

OR / अथवा

Discuss any four agro-ecological zones in India in detail.

भारत में किन्हीं चार कृषि-पारिस्थितिक क्षेत्रों की विस्तृत चर्चा कीजिए।

4. Explain the core periphery model as a model of regional planning.

क्षेत्रीय योजना के मॉडल के रूप में कोर मॉडल की व्याख्या करें।

OR / अथवा

P.T.O.

Critically analyse the relevance of Growth Foci concept with reference to regional planning in India.

भारत में क्षेत्रीय नियोजन के संदर्भ में वृद्धि - केन्द्र अवधारणा की प्रासंगिकता का समालोचनात्मक विश्लेषण करें।

5. Define backward regions. Give a brief account of Special Area Development Plans in India.

पिछड़े क्षेत्रों को परिभाषित कीजिए। भारत में विशेष क्षेत्र विकास योजनाओं का संक्षिप्त विवरण दीजिए।

OR / अथवा

Discuss the characteristics, problems and policies of Damodar Valley Corporation (DVC).

दामोदर घाटी निगम (डी.वी.सी) की विशेषताओं, समस्याओं और नीतियों की चर्चा कीजिए।

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5885

G

Unique Paper Code : 62136949

Name of the Paper : Basic Elements of Ayurveda

Name of the Course : B.A. (P), SEC

Semester : III

Duration : 3 Hours

Maximum Marks : 75

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Unless otherwise required in a question answers should be written either in Sanskrit or in Hindi or in English, but the same medium should be used throughout the paper.
3. There are total 6 questions in this question paper. Attempt any 5 questions. Each question contains equal marks.

P.T.O.



### छात्रों के लिए निर्देश

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए ।
2. अन्यथा आवश्यक न होने पर, इस प्रश्नपत्र का उत्तर संस्कृत या हिन्दी या अंग्रेजी किसी एक भाषा में दीजिए, लेकिन सभी उत्तरों का माध्यम एक ही होना चाहिए ।
3. इस प्रश्नपत्र में कुल 6 प्रश्न हैं । इनमें से किन्हीं 5 प्रश्नों के उत्तर दीजिए । सबके अंक समान हैं ।

1. आयुर्वेद का परिचय तथा धन्वन्तरि परम्परा का ऐतिहासिक वर्णन कीजिए ।

Give an introduction to Ayurveda and a historical description of the Dhanvantari tradition.

2. विसर्ग काल में हमारे शरीर पर पड़ने वाले प्रभावों का वर्णन करें ।

Describe the effects of Visarg kala on our body.

3. निम्नलिखित में से दो पर टिप्पणी लिखें :

Write short note on any two of the following :

(i) सुश्रुत

(Sushruta)

(ii) वाग्भट्ट

(Vagbhata)

(iii) माधव

(Madhava)

4. हेमन्त तथा शरद ऋतु में पथ्य-अपथ्य तथा विहार का विवेचन करें ।

Describe wholesome-unwholesome diets and activities in Fall Winter and Autumn seasons.

5. चरक-संहिता पर एक निबन्ध लिखिए ।

Write an essay on Charak Samhita.

P.T.O.

6. तैत्तिरीयोपनिषद् की भृगुवल्ली के प्रथम तीन अनुवाकों का सार लिखिए ।

Write a summary of the first three anuvaak of Bhriguvalli of Taittiriyaopanishad.

19

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4734

G

Unique Paper Code : 42353504

Name of the Paper : Transportation and Network  
Flow Problems

Name of the Course : B.Sc. (Prog.) – SEC

Semester : V

Duration : 3 Hours

Maximum Marks : 55

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. This question paper has **FOUR** questions in all.
3. **All** questions are compulsory.

1. Three orchards supply crates of oranges of four retailers. The daily demand amounts at the four retailers are 150, 150, 400 and 100 crates, respectively. Supplies at the three orchards are dictated by available regular labor and estimated at 150, 200 and 250 crates daily. The transportation costs per crate from the orchards to the retailers are given in table

P.T.O.



|         |   | Table: Transportation Cost / Crate |     |     |     |
|---------|---|------------------------------------|-----|-----|-----|
|         |   | Retailer                           |     |     |     |
|         |   | 1                                  | 2   | 3   | 4   |
| Orchard | 1 | \$1                                | \$2 | \$3 | \$2 |
|         | 2 | \$2                                | \$4 | \$1 | \$2 |
|         | 3 | \$1                                | \$3 | \$5 | \$3 |

Formulate the problem as a transportation model.

(5)

2. Attempt any five parts from the following :

- (i) Compare the initial basic feasible solution obtained by the Northwest-Corner method and Least-Cost Method for the following transportation problem :

(6)

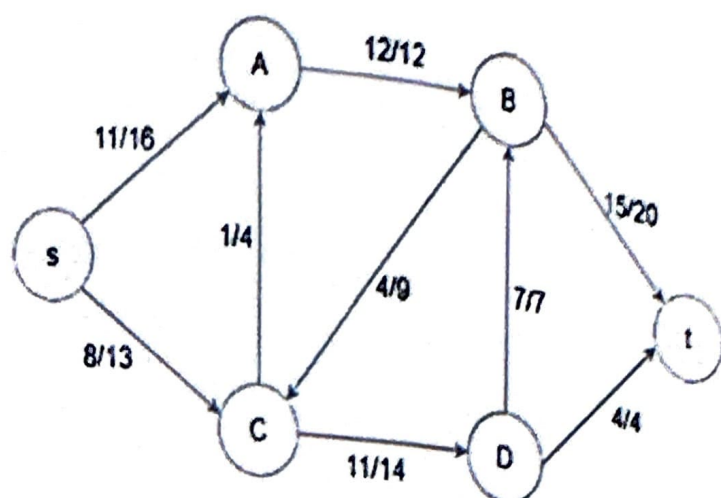
|        |   | Destination |    |    | Supply |
|--------|---|-------------|----|----|--------|
| Source | 2 | 7           | 4  | 5  |        |
|        | 3 | 3           | 1  | 8  |        |
|        | 5 | 4           | 7  | 7  |        |
|        | 1 | 6           | 2  | 14 |        |
| Demand | 7 | 9           | 18 | 34 |        |

- (ii) The head of department of mathematics has to assign four jobs to three peons. The peons differ in efficiency. The estimates of the time each peon would take to perform a task are given in the following matrix. How should the head allocate the jobs, one to each peon, so as to minimize the total man-hours? (6)

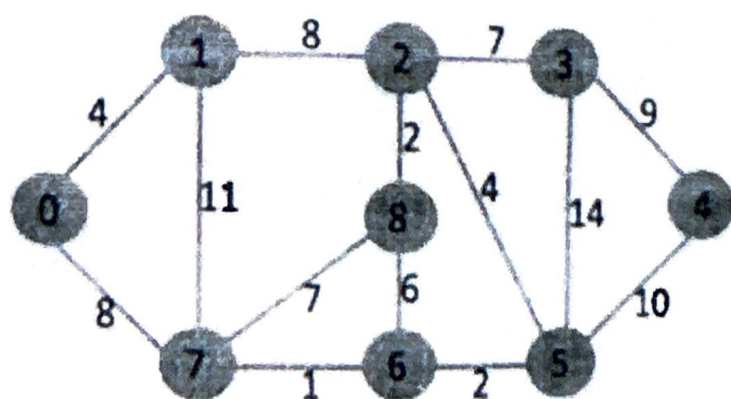
|      |     | Peon |    |     |
|------|-----|------|----|-----|
|      |     | I    | II | III |
| Jobs | I   | 9    | 26 | 15  |
|      | II  | 13   | 27 | 6   |
|      | III | 35   | 20 | 15  |
|      | IV  | 18   | 30 | 20  |

- (iii) In the network shown below, find the flow pattern that gives the maximal flow from node s (source) to node t (sink) where the arc capacities are mentioned on respective arcs (6)

P.T.O.



- (iv) Midwest TV cable Company is in the process of providing cable service to new housing development areas. The below figure depicts possible TV linkages among the areas. The cable miles are shown on each arc. Determine the most economical cable network starting at node 0.
- (6)



- (v) Draw the Network defined by the sets  $N = \{1, 2, 3, 4, 5\}$  :

$$A = \{(1, 2), (1, 3), (2, 5), (3, 5), (3, 4), (4, 5), (5, 1), (4, 2)\}$$

Also determine (a) a path (b) a cycle (c) a tree  
(d) a spanning tree. (6)

- (vi) For the data given below, find the following :

(a) Construct the network.

(b) The expected task times and their variances, and

(c) The critical path. (2+2+2=6)

| Task | Least time (days) | Most likely time (days) | Greatest time (days) | Task | Least time (days) | Most likely time (days) | Greatest time (days) |
|------|-------------------|-------------------------|----------------------|------|-------------------|-------------------------|----------------------|
| A    | 3                 | 5                       | 6                    | G    | 5                 | 7                       | 9                    |
| B    | 1                 | 2                       | 3                    | H    | 6                 | 9                       | 12                   |
| C    | 2                 | 4                       | 6                    | I    | 1                 | 2                       | 3                    |
| D    | 6                 | 8                       | 12                   | J    | 3                 | 6                       | 8                    |
| E    | 8                 | 12                      | 17                   | K    | 8                 | 15                      | 20                   |
| F    | 0                 | 0                       | 0                    | L    | 2                 | 4                       | 6                    |

P.T.O.



3. A company has three warehouses  $W_1$ ,  $W_2$ , and  $W_3$ . It is required to deliver a product from these warehouses to three customers A, B, and C. The warehouses have following units in stock. (10)

| Warehouse    | $W_1$ | $W_2$ | $W_3$ |
|--------------|-------|-------|-------|
| No. of units | 65    | 42    | 43    |

and the customer requirements are :

| Customer     | A  | B  | C  |
|--------------|----|----|----|
| No. of units | 70 | 30 | 50 |

The table below shows as the costs of transporting one unit from warehouse to the customer :

|          |   | Warehouse |       |       |
|----------|---|-----------|-------|-------|
|          |   | $W_1$     | $W_2$ | $W_3$ |
| Customer | A | 5         | 7     | 8     |
|          | B | 4         | 4     | 6     |
|          | C | 6         | 7     | 7     |

- (a) Use the Vogel Approximation method to find the initial basic feasible solution.
- (b) Use the starting feasible solution (from above part) to find the optimal solution.

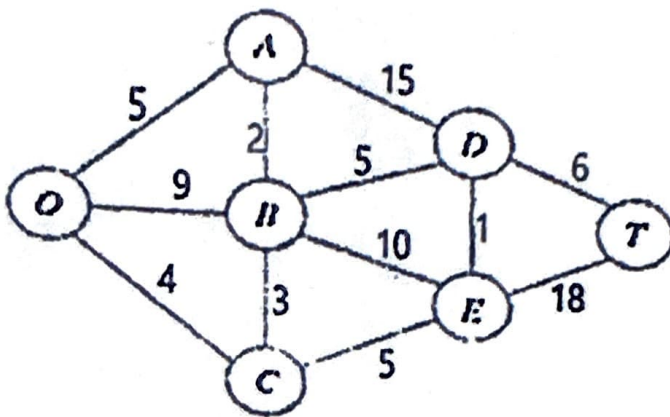
4. Attempt any **one** of the following :

(10)

(i) The network in the following figure gives the distances in miles between pairs of cities. Use Dijkstra's algorithm to find the shortest route between :

(a) Cities O and T;

(b) Cities A and E.



(ii) A machine operator processes five types of items on his machine each week, and must choose a sequence for them. The setup cost per change depends on the item presently on the machine and the setup to be made according to the following table :

P.T.O.

20  
[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5720

**G**

Unique Paper Code : 62343502

Name of the Paper : Open Source Software

Name of the Course : **B.A. (Prog.) Computer applications**  
**(Skill Enhancement Course)**

Semester : V

Duration : 2 Hours

Maximum Marks : 25

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Answer any **three** questions from **Section B**.
4. Parts of the question must be answered together.

P.T.O.

## Section A

1. (a) What does GIMP stand for?

(10×1=10)

- (i) GNU Image Manipulation Program
  - (ii) GNU Image Multiplication Program
  - (iii) GNU Image Making Program
  - (iv) GNU Image Masking Program
- (b) A set of sequentially indexed elements having the same type of data is known as :
- (i) Loop
  - (ii) Array
  - (iii) Objects
  - (iv) Variables



(c) Which of the following control is used to display text, but user cannot change it directly?

(i) TextBox

(ii) Label

(iii) ListBox

(iv) Command Button

(d) To create a circle shape in GIMP, which of the following tool is used?

(i) Rectangle

(ii) Ellipse

(iii) Lasso

(iv) Path

P.T.O.

(e) RTF is acronym for :

- (i) Rich Text Format
- (ii) Rich Title Format
- (iii) Row Text Format
- (iv) Rich Text Function

(f) The clone tool allows you to :

- (i) Create a shape
- (ii) Change the size
- (iii) Paint with a brush
- (iv) Duplicate an area.

(g) The process of finding and removing errors is known as :

- (i) Check

- (ii) Debugging
  - (iii) Quick watch
  - (iv) Break
- (h) The variables that does not change the value during execution of program is known as :
- (i) Numeric
  - (ii) Constant
  - (iii) String
  - (iv) All of the above
- (i) Name a method which moves the focus to the specified control or form from the given as following :
- (i) setFocus()
  - (ii) gotFocus()

P.T.O.

(iii) lostFocus()

(iv) None of these

(j) Which of the following indicates whether a particular condition is on or off?

(i) ComboBox

(ii) ListBox

(iii) Checkbox

(iv) None of these

### Section B

2. (a) State the significance of the term Warranty of fitness. (3)

(b) List the issues generally encountered with Copyright and Patent. (2)



3. (a) List any three properties of software package GAMBAS. (3)

(b) Write a program using GAMBAS to add first 10 natural nos. (2)

4. (a) Briefly explain the usefulness of Mozilla Public License.

Under what circumstances one should use Mozilla Public License? (3)

(b) Write the usefulness of Royalties. How is it used to maintain the relationship between a creator and a publisher? (2)

5. (a) Explain any three major benefits of Open Source Licensing. (3)

(b) List any two advantages and disadvantages of Open Source software over Commercial software. (2)

P.T.O.

6. (a) Name any one Open Source Web Server. How Open Source License is different from Academic Free License? (3)
- (b) How does an Open Source Software community form? (2)

(1000)