This Question Booklet contains 16 printed pages

PGEE

Total Marks : 100
Time : 100 Minutes

Question Booklet Code : **A**

A
Seal Sticker

Candidate's Seat No. :

Candidate's Signature _____ **Block Supervisor's Signature** _____

DO NOT OPEN QUESTION BOOKLET UNTIL INSTRUCTED.

INSTRUCTIONS FOR CANDIDATE:

1. Check Number printed on your OMR SHEET and Question Paper with your SEAT No. before answering the questions. Consult block supervisors in case the above mentioned numbers do not match with your seat number.
2. There are total 100 questions. For answer of each question A, B, C, D, E options are given in OMR SHEET. In OMR SHEET, there is "E" option. "E" option is for "Not Attempted". If candidate do not wish to answer the question he/she should select "E" option (Not Attempted). All questions are compulsory.

   For Example:

   Which state of India has the longest sea shore ?

   A ○ B ○ C ● D ○ E ○

   (A) Maharashtra (B) Tamilnadu

   (C) Gujarat (D) Andhra Pradesh

   In this example, the right answer is (C). Therefore, the Circle of (C) has been darkened (encoded). Candidate should not give the answer "Gujarat" in writing.

   The options once darkened/answered by candidate cannot be changed.
3. Candidates are not permitted to leave examination hall during examination.
4. Candidates must strictly enter SEAT NO. in the designated space provided in OMR SHEET as well as Question Paper neatly as soon as they receive the OMR SHEET & Question Paper.
5. Candidates must not write name or put any identification sign/symbol on OMR SHEET. In such case strict disciplinary action will be taken against candidate & will be considered disqualified/ineligible. Only Seat No. must be entered at designated space provided in OMR SHEET.
6. Both, Candidate's & Supervisor's signature must be done on Certificate of OMR SHEET. Unsigned OMR SHEET would not be considered for evaluation.
7. Candidates are not permitted to use or carry with them any kind of literature, guide, hand written notes, or printed books, mobile phone, pagers, smart watches, camera or any electronic gadgets to examination hall.
8. Use of only Non-scientific / Non-programmable calculator shall allow during examination.
9. Candidates are not permitted to talk/discuss in the Examination Hall. Any candidate found violating supervisor's instructions will be disqualified.
10. Candidates must fully darken circle A, B, C, D and E accordingly with Blue / Black ball pen. If answers are marked with any other coloured ball pen, pencil, white ink (whitner), any corrections are done by candidate by means of blade or rubber or whitner will not be considered for evaluation.
11. Candidates may carry QP with them after Examination.
12. **For correct answer 1 (One) marks will be given.**

    If candidate gives more than one option as answer for one question in answer sheet (OMR SHEET), or gives wrong answer then the candidate will be allotted Zero (0) marks.

    If candidate does not want to answer a particular question and marks (E) or leave the option without encoding on OMR sheet, then no minus marks will be given.

Submit the OMR SHEET to the block supervisor after completion of examination without fail before leaving examination hall, failure to do so will result in disqualification of the candidature for the examination and disciplinary action will be taken against such candidate.

SPACE FOR ROUGH WORK / રફ કામ માટેની જગ્યા

1. The average power delivered to an impedance (4 – j3) Ω by a current 5 cos (100πt + 100) A is:

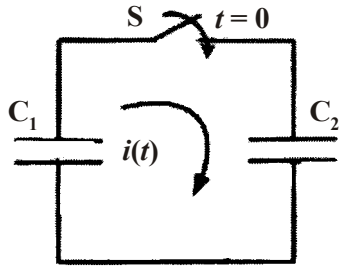
(A) 44.2 W

(B) 62.5 W

(C) 50 W

(D) 125 W

2. In the following figure, C1 and C2 are ideal capacitors. C1 has been charged to 12 V before the ideal switch is closed at t = 0. The current i(t) for all t is:



(A) A step function

(B) An impulse function

(C) Zero

(D) An exponentially decaying function

3. A network contains linear resistors and ideal voltage sources only. If the value of all the resistors are doubled, then voltage across each resistor will

(A) Become half

(B) Become double

(C) Increased by four times

(D) No change

4. With 10 V dc connected at port A in the linear reciprocal network shown below. The following were observed.

1. 1 Ω connected at port B draws a current of 3 A.

2. 2.5 Ω connected at port B draws a current of 2 A.

For the same network, with 10 V dc connected at port A, the current drawn by 7 Ω connected at port B is:

(A) 3/7 A

(B) 1 A

(C) 5/7 A

(D) 9/7 A

5. Consider a star network in which three resistances Ra, Rb and Rc are connected to terminals A, B and C respectively. The resistance between terminals A and B with C open is 6 Ω, between B and C with A open is 11 Ω, and between C and A with B open is 9 Ω. Then

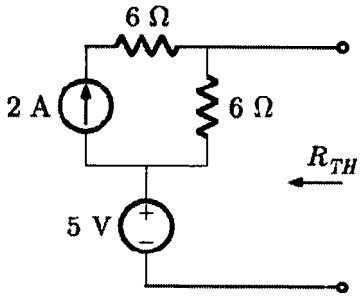
(A) Ra = 2Ω, Rb = 4Ω, Rc = 7Ω

(B) Ra = 5Ω, Rb = 1Ω, Rc = 10Ω

(C) Ra = 4Ω, Rb = 2Ω, Rc = 5Ω

(D) Ra = 3Ω, Rb =3Ω, Rc = 4Ω

6. For the following circuit the value of RTh is :



(A) ∞ (B) 3Ω

(C) 6Ω (D) 12Ω

7. A bulb in a staircase has two switches, one switch being at the ground floor and the other one at the first floor. The bulb can be turned ON and also can be turned OFF by any one of the switches irrespective of the state of the other switch. The logic of switching of the bulb resembles

(A) an AND gate (B) an XOR gate

(C) an OR gate (D) a NAND gate

8. Find the force between 2C and -1C separated by a distance 1m in air(in newton).

(A) 18×10^6 (B) 18×10^9

(C) 18×10^6 (D) 18×10^{12}

9. The Gauss divergence theorem converts

(A) line to surface integral (B) line to volume integral

(C) surface to line integral (D) surface to volume integral

10. Which of the following cannot be computed using the Biot Savart law?

(A) Magnetic field intensity (B) Magnetic flux density

(C) Electric field intensity (D) Permeability

11. Find the magnetic flux density of a finite length conductor of radius 12cm and current 3A in air

(A) 4×10^{-6} unit (B) 5×10^{-6} unit

(C) 6×10^{-6} unit (D) 7×10^{-6} unit

12. For a given transformer volte/turn for primary and secondary winding is

(A) same (B) depends on load

(C) different (D) depends on transformer design

13. In transformer the load current is kept constant, while the power factor is varied. Under this situation the zero voltage regulation is observed.

(A) Independent of the load power factor (B) Load power factor is unity

(C) Load power factor is lagging (D) Load power factor is leading

14. Under load condition the efficiency of two identical transformers can be measured by

(A) Cascade test (B) Sumpner's test

(C) Blocked rotor test (D) No load test

15. Generally the no load losses of an electrical machines is represented in its equivalent circuit by

(A) Parallel resistance with high value (B) series resistance with low value

(C) Parallel resistance with low value (D) series resistance with high value

16. In order to minimize the inrush current in the single phase transformer, the supply switch should be closed at the instant when:

(A) Supply voltage is $\frac{1}{2}$ times the maximum voltage

(B) Supply voltage is $\frac{1}{\sqrt{2}}$ times the maximum voltage

(C) Supply voltage is equal to the maximum voltage

(D) Supply voltage is zero

17. When a V-V system is converted in to Δ-Δ system the efficiency of the transformer is increased by _____%

(A) 86.6 (B) 57.7

(C) 73.2 (D) 66.7

18. Two transformers operating in parallel will share the load depending upon their

(A) Rating (B) Efficiency

(C) Leakage reactance (D) Per unit impedance

19. Two transformers are to be operated in parallel such that they share load in proportion to their kVA ratings. The rating of first transformer is 500 kVA and its leakage impedance is 0.05 pμ. If the rating of second transformer is 250 kVA then its pu leakage impedance is

(A) 0.05 (B) 0.1

(C) 0.2 (D) 0.025

20. Determine the ratio of weight of copper in an auto transformer and two winding transformer if the transformation ratio is 4.

(A) 3/4 (B) 1/3

(C) 1/4 (D) 1/2

21. A 4 pole DC machine is running at 1500 rpm. What is the frequency of current in the armature winding?

(A) 50 Hz (B) 25 Hz

(C) 0 Hz (D) 100 Hz

22. Which of the following generators at load condition offer positive poorest voltage regulation?

(A) Shunt generator (B) Cumulative compounded generator

(C) Differential compounded generator (D) Series generator

23. Which of the following is the disadvantage of flux control method of a DC shunt motor?

(A) Power loss in external resistance is very high

(B) The speed control below normal rated speed is not possible

(C) It is a complex method

(D) It is economical method

24. A ceiling fan uses

(A) Split phase motor (B) Capacitor start motor

(C) Universal motor (D) Capacitor start capacitor run motor

25. A three phase induction motor has four poles and operates with a slip of 0.04 with 50 Hz supply for a certain load. The speed of the rotor magnetic field with respect to stator is:

(A) 1440 RPM (B) 60 RPM

(C) 1500 RPM (D) 0 RPM

26. The parameter of an equivalent circuit of a three phase induction motor affected by reducing the RMS value of the supply voltage at the rated frequency is

(A) Rotor resistance (B) Rotor leakage reactance

(C) Stator resistance (D) Magnetizing reactance

27. A synchronous motor will deliver maximum power when

(A) Load angle is equal to internal angle (B) Input power factor is unity

(C) Load angle is 45 degree (D) Load angle is 0 degree

28. In the case of Zero Power factor leading load on the alternator, the effect of armature reaction is

(A) To demagnetize (B) To increase induced emf

(C) To cross magnetize (D) To decrease induced emf

29. A magnetisation curve represents the relationship between

(A) reactive and non-reactive components of voltage

(B) power factor and terminal voltage

(C) exciting currents and terminal voltage

(D) Magnetic flux and armature current.

30. In an alternator, voltage drops occurs in

(A) Armature resistance, leakage reactance, & armature reaction

(B) Leakage reactance

(C) Armature resistance, leakage reactance, armature reaction and earth connections.

(D) Armature resistance

31. The auxiliary power consumption in a thermal (steam) power station is

(A) 5-10% (B) 15-20%

(C) 2-5% (D) 10-15%

32. If a generating station is situated very close to the load centre, the penalty factor for the unit is

(A) Almost unity (B) Very high

(C) Zero (D) Negative

33. Making capacity of the circuit breaker depends on

(A) Operating Voltage (B) Fault current

(C) Short circuit MVA (D) All the above

34. Number of insulator discs, each rated 11 kV, required in a suspension type insulator string of 66 kV line is _____.

(A) More than 6 (B) Less than 6

(C) 6 (D) 12

35. While testing a specimen for dielectric strength, the shape should be so prepared that

(A) The electric stress is at its corner
(B) The electric stress is same at all the points
(C) The electric stress is high at its centre
(D) None of the above

36. The phenomena taking place when the neutral of system is ungrounded following an LG fault is known as _____

(A) Thomson Effect
(B) Skin effect
(C) Ferranti effect
(D) Arcing ground

37. Most versatile and accurate method of achieving reactive power compensation is by using

(A) Fixed capacitor with controlled reactor
(B) Switched capacitor with controlled reactors
(C) Switched capacitor
(D) Switched reactor with capacitive bank

38. Unit commitment means

(A) Switching of generator Economically
(B) Loss allocation on generator
(C) Economic distribution of load on generator
(D) All the above

39. In N R Method of load flow, number of iterations...

(A) depends on the size of system
(B) depends on selection of Slack bus
(C) are almost constant
(D) depends on no. of load buses

40. _____ is a sparse matrix

(A) Impedance matrix
(B) Resistance matrix
(C) Admittance matrix
(D) Incidence matrix

41. In case of HVDC transmission there is

(A) no charging current no skin effect
(B) both charging effect and skin effect
(C) charging current but no skin effect
(D) no charging current but skin effect

42. Critical clearing time of a fault in a power system is related to

(A) Short circuit limit
(B) Steady state limit
(C) Reactive power limit
(D) Transient stability limit

43. For making an unstable system stable,

(A) Gain of the system should be increased.
(B) The number of zero to loop transfer functions should be increased.
(C) Gain of the system should be decreased.
(D) The number of poles to loop transfer functions should be increased.

44. The amount of additional phase lag which can be introduced into the system till it reaches the verge of instability is called

(A) Phase Margin.
(B) Gain Margin.
(C) Gain cross over.
(D) Phase cross over.

45. The number of roots of the equation $2s^4 + s^3 + 3s^2 + 5s + 7 = 0$, which lie to the right half of the 's' plane is

(A) Three (B) Two

(C) Zero (D) One

46. Which of the following systems has a tendency to oscillate?

(A) Open loop system. (B) Both open and closed loop system.

(C) Closed loop system. (D) Neither open nor closed loop system.

47. The root locus is symmetrical about the real axis because

(A) Complex roots occur in conjugate pairs.

(B) All roots occur in pairs.

(C) Roots occur simultaneously in the left hand and right hand plane.

(D) Roots occur only on right hand plane.

48. If the complex poles of a system have greater real parts, then the overshoot is

(A) More (B) Sometimes less and sometimes more.

(C) Less (D) Not affected.

49. Routh's array for a system is given below.

s4	1	3	5
s3	1	2	0
s2	1	5	
s1	-3		
s0	5		

The number of roots of the characteristic polynomial in RHP of the system is

(A) 1 (B) 2

(C) 3 (D) 4

50. The transfer function of a system is 10/(1+s). The steady state error to unit step input when operated as a unity feedback system is

(A) 10 (B) 1/10

(C) 5 (D) 0

51. A wattmeter is reading back-wards in an experiment. Upscale reading can be obtained by reversing

(A) Pressure coil connection only

(B) Both pressure and current coil connection only

(C) Current coil connection only

(D) Either pressure or current connection

52. A Wheatstone bridge cannot be used for precision measurements because errors are introduced into on account of

(A) Resistance of connecting leads (B) Contact resistances

(C) Thermo-electric emfs (D) All of these

53. In an L.V.D.T. the two secondary windings are connected in differential to obtain

(A) Higher voltage

(B) In order to establish the null or the reference point for the displacement of the core

(C) An output voltage which is phase sensitive i.e. the output voltage has a phase which can lead us to a conclusion whether the displacement of the core took place from right to left or from left to right

(D) Both (B) and (C)

54. A _____ device prevents the oscillations of the moving system and enables the latter to reach its final position quickly

(A) Deflecting device (B) Damping device

(C) Controlling device (D) Any one of the above

55. The multiplier and the meter coil in a voltmeter are in

(A) series (B) series-parallel

(C) parallel (D) none of the above

56. For measurement of current at high frequency we should use

(A) moving iron meters (B) electrostatic instrument

(C) Thermocouples instrument (D) None of the above

57. The _____ of a circuit describes the ability of that circuit to respond to certain frequencies while rejecting all others.

(A) bandwidth (B) sensitivity

(C) selectivity (D) quality factor

58. The effective reactance of an inductive coil

(A) decreases because of stray capacitance as the frequency increases

(B) remain the same irrespective of the increase in frequency even if stray series capacitances are present

(C) increases because of stray capacitance as the frequency increases

(D) none of the above

59. Murray loop test can be used for location of

(A) ground fault on a cable

(B) both the ground fault and the short-circuit fault

(C) short circuit fault on a cable

(D) none of the above

60. The temperature transducers exhibit non-linear behaviour. The order in which they exhibit non linearity(highest to lowest) is

(A) Thermocouples, RTD, Thermistor (B) RTDs, thermocouples, Thermistor

(C) Thermistor, thermocouples, RTDs (D) Thermistor, RTDs, thermocouples

61. The _____ gate is used as two bits comparator.

(A) AND (B) NAND

(C) OR (D) EX-OR

62. When a large sine wave drives Schmitt trigger, the output is a

(A) Triangular wave (B) Series of ramps

(C) A rectangular wave (D) Rectified sine wave

63. An astable multivibrator has

(A) Two stable state (B) Two quasi-stable state

(C) One stable state (D) One quasi-stable state

64. The most commonly used amplifier in sample & hold circuits is

(A) A unity gain non-inverting amplifier (B) An inverting amplifier with a gain of 10

(C) A unity gain inverting amplifier (D) An inverting amplifiers with a gain of 100

65. An analog to digital converter consists of

(A) DAC, comparator, logic gates and a counter

(B) Only a DAC

(C) A DAC and a counter

(D) DAC and logic gates

66. In microprocessor architecture, flag indicates the

(A) bit-size of the microprocessor

(B) number of microprocessor

(C) internal status of the central processing unit

(D) none of the above

67. An emitter follower has high input impedance because

(A) Large emitter resistance is used

(B) There is negative feedback in the base emitter circuit

(C) Large biasing resistance is used.

(D) The emitter-base junction is highly reverse biased.

68. In a differential amplifier an ideal CMRR is

(A) infinity (B) –1

(C) zero (D) 1

69. The zero-level detector is one application of a

(A) Comparator (B) Summing Amplifier

(C) Differentiator (D) Diode

70. In order to handle all combinations of input voltage polarities, a multiplier must have

(A) Three-quadrant capability (B) Dual-supply voltages

(C) Four-quadrant capability (D) Four inputs

71. A dc chopper is fed from 100 V dc. Its load voltage consists of rectangular pulses of duration 1 msec in an overall cycle time of 3 msec. the average output voltage and ripple factor for this chopper are respectively

(A) 25V, 1 (B) 33.33V, 1.41

(C) 50V, 1 (D) 33.33V, 1

72. for a 12 pulse operation, the two 6 pulse units are fed by,

(A) Δ-Δ and Δ-Δ transformers (B) Y-Δ and Y-Δ transformers

(C) Y-Y and Y-Y transformers (D) Y-Y and Y-Δ transformers

73. which of these converter produce negative signed output voltage for positive input voltage,

(A) boost converter (B) fly-back converter

(C) buck converter (D) buck-boost converter

74. Once SCR starts conducting a forward current, its gate losses control over:

(A) anode circuit voltage only (B) anode circuit voltage and current

(C) anode circuit current only (D) none of the above

75. A dc motor operated from phase controlled converter, its commutation capability deteriorates due to the presence of

(A) peaks in armature current (B) discontinuous conduction

(C) harmonics in the armature current (D) all of above

76. For single-phase ac to dc controlled rectifier to operate in regenerative mode, which of the following conditions should be satisfied?

(A) Half controlled bridge, $\alpha>90°$, source of emf in load

(B) Half controlled bridge, $\alpha<90°$, source of emf in load

(C) Full controlled bridge, $\alpha>90°$, source of emf in load

(D) Full controlled bridge, $\alpha<90°$, source of emf in load

77. A 3-phase AC voltage controller feed in an IM drive has an output of

(A) constant voltage constant frequency (B) variable voltage constant frequency

(C) constant voltage variable frequency (D) variable voltage variable frequency

78. In converter the purpose to insert dead band is to

(A) improve power factor (B) obtain better controllability

(C) avoid short circuiting the source (D) none of the above

79. HVDC transmission systems generally use,

(A) 12 pulse converters (B) 3 pulse converters

(C) 6 pulse converters (D) either 12 or 6 pulse converters

80. A single phase transmission line of impedance j0.8 ohm supplies a resistive load of 500A at 300V. The sending power factor is

(A) unity (B) 0.8 leading

(C) 0.8 lagging (D) 0.6 lagging

81. Eigen values of the matrix "A" are _____, where $A=\begin{bmatrix}5 & 4\\ 1 & 2\end{bmatrix}$

(A) 1, 6 (B) 5, 2

(C) –1, 6 (D) 5, –2

82. Which of the following Statements are true in general?

Statement 1 : Singular matrix is always a square matrix.

Statement 2 : Every square matrix has determinant.

Statement 3 : Every square matrix satifies its own characteristics equation.

(A) Only Statement 1

(B) Statement 1 and 2

(C) Statement 1 and 3

(D) Statement 2 and 3

83. Which of the following is correct pair of Cauchy - Riemann Equations ?

Here $f(z) = u(x,y) + i\, v(x,y)$ is given.

(A) $\frac{\partial u}{\partial y}=\frac{\partial v}{\partial x}$ and $\frac{\partial u}{\partial x}=\frac{\partial v}{\partial y}$

(B) $\frac{\partial u}{\partial y}=\frac{-\partial v}{\partial x}$ and $\frac{\partial u}{\partial x}=\frac{-\partial v}{\partial y}$

(C) $\frac{\partial u}{\partial x}=\frac{\partial v}{\partial x}$ and $\frac{\partial u}{\partial y}=\frac{-\partial v}{\partial y}$

(D) $\frac{\partial u}{\partial x}=\frac{\partial v}{\partial y}$ and $\frac{\partial u}{\partial y}=\frac{-\partial v}{\partial x}$

84. Evaluate $\lim_{x \to a} \frac{\log(x-a)}{\log(e^x - e^a)}$

(A) 0

(B) 1

(C) -1

(D) None of the above

85. Find $\frac{dy}{dx}$ if $x^3 + y^3 = 7xy$.

(A) $(7y - 3x^2) / (3y^2 - 7x)$

(B) $(3x^2 - 7y) / (3y^2 - 7x)$

(C) $(3y^2 - 7x) / (7y - 3x^2)$

(D) None of the above

86. Find the directional derivative of $x^2 y^2 z^2$ at the Point (1, 1, –1) in the direction of the tangent to the curve $x = e^t$, $y = \sin 2t + 1$ and $z = 1 - \cos t$ at $t = 0$.

(A) 0

(B) 1

(C) $\frac{6}{\sqrt{5}}$

(D) $\frac{5}{\sqrt{6}}$

87. Laplace Transform of $t^3 . e^{-2t}$ is _____

(A) $3! / (S - 2)^4$

(B) $3! / (S + 2)^4$

(C) $4! / (S - 2)^4$

(D) $4! / (S + 2)^4$

88. If $x = r\cos\theta$, $y = r\sin\theta$ then find out Jacobian $\frac{\partial(x,y)}{\partial(r,\theta)}$

(A) r

(B) 1/r

(C) 0

(D) 1

89. Which of the following is an iterative method to solve ordinary differential equations?

(A) False Position Method

(B) LU Decomposition method

(C) Newton-Raphson Method

(D) Picard's method

90. Find the inverse Laplace Transform of the function $\frac{5}{(S-2)(S+3)}$

(A) $e^{-2t} + e^{-3t}$ (B) $e^{-2t} + e^{3t}$

(C) $e^{-2t} - e^{3t}$ (D) $e^{2t} - e^{-3t}$

91. The solution of differential equation $\frac{dy}{dx} = e^{x+y}$ is _____.

(A) $e^x + e^y = c$ (B) $e^x + e^{-y} = c$

(C) $e^x - e^y = c$ (D) $e^x - e^{-y} = c$

92. Solve the differential equation, $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = e^{4x}$

(A) $y = \frac{1}{2}e^{4x} + c_1 + c_2 x$ (B) $y = c_1 e^{2x} + c_2 e^{-3x} + x$

(C) $y = c_1 e^{2x} + c_2 e^{3x} + \frac{1}{2}e^{4x}$ (D) None of above

93. The probability of an Impossible event is _____

(A) 0 (B) 1

(C) Between 0 and 1 (D) None of the above

94. Evaluate $\int_0^1 \frac{1}{1+x}dx$ taking h = 1 using Simpson's $\frac{1}{3}$ rule. (correct up to 3 decimal places)

(A) 1.0092 (B) 1.1959

(C) 1.1991 (D) 1.2172

95. Evaluate $\oint \frac{e^z}{z^2+1}dz$ over the circle $|z| = 2$

(A) $2\pi i$ (B) Sin(1)

(C) $2\pi i.\sin(1)$ (D) $2\pi i / \sin(1)$

96. Find the residue of $\frac{1}{(z+1)^4}$ at its pole.

(A) 0 (B) 1

(C) –1 (D) 5/9

97. For a Binomial Distribution with $n = 20$, $p = 0.35$ (probability of success) then find Variance

(A) 2.45 (B) 4.55

(C) 8.45 (D) 4.3225

98. **Two unbaised dice are tossed simutaneously. Find the probability that the sum of numbers on the upper face of dice is 9 or 12.**

(A) 4/36 **(B) 1/36**

(C) 5/36 **(D) None of the above**

99. **Find the median of 10, 23, 18, 38, 65, 92, 40, 58**

(A) 38 **(B) 65**

(C) 40 **(D) 39**

100. **For $F(x,y)$ we define,**

$$r=\frac{\partial^2 F}{\partial x^2}, S=\frac{\partial^2 F}{\partial x \partial y}, t=\frac{\partial^2 F}{\partial y^2}$$

Which of the following condition is true for $F(x,y)$ to have maxima?

(A) $rt - S^2 < 0, r > 0$ **(B)** $rt - S^2 < 0, r < 0$

(C) $rt - S^2 > 0, r > 0$ **(D)** $rt - S^2 > 0, r < 0$

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