# University of Mumbai

## Examination 2020 under cluster 3 (Lead College: FCRIT,VASHI)

**Examinations Commencing from 22rd April 2021 to 30 th April 2021**

Program: First Year Engineering

Curriculum Scheme: Rev2019 C Scheme

Examination: FE Semester I

Course Code: FEC101 and Course Name: Engineering Mathematics - I

Time: 2 hour Max. Marks: 80

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| **Q1.** | **Choose the correct option for following questions. All the Questions are compulsory and carry equal marks** |
|---|---|
| | |
| 1. | The value of tanh (log x) ,if $x = \sqrt{2}$ ,will be given by |
| Option A: | $\sqrt{2}$ |
| Option B: | $\frac{1}{4}$ |
| Option C: | 2 |
| Option D: | $\frac{1}{3}$ |
| | |
| 2. | If $z = e^{i\theta}$, the value of $z^6 - \frac{1}{z^6}$ will be given by |
| Option A: | 2i sin 6θ |
| Option B: | 2 sin 6θ |
| Option C: | 2 cos 6θ |
| Option D: | -2i sin 6θ |
| | |
| 3. | The real part of $z = \sqrt{i}$ will be given by |
| Option A: | 1 |
| Option B: | -1 |
| Option C: | $\frac{1}{2}$ |
| Option D: | $\frac{1}{\sqrt{2}}$ |
| | |
| 4. | Find x , if 5 sinh x – cosh x = 5 |
| Option A: | x = log 3 |
| Option B: | $x = e^3$ |
| Option C: | x = -log 3 |
| Option D: | x = - 3 |
| | |
| 5. | Roots of $x^3 - i = 0$ are |
| Option A: | $e^{\frac{i(2k\pi+\pi)}{6}}$ , k = 0,1,2 |
| Option B: | $e^{\frac{i(4k\pi+1)}{6}}$ , k = 0,1,2 |
| Option C: | $e^{\frac{i(4k\pi+\pi)}{6}}$ , k = 0,1,2 |
| Option D: | $e^{\frac{i(4k\pi+\pi)}{3}}$ , k = 0,1,2 |

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|---|---|
| 6. | What is the value of $sinh^{-1}(tan\theta)$ |
| Option A: | $log\left(sec\frac{\theta}{2} + tan\frac{\theta}{2}\right)$ |
| Option B: | $log(sec\theta + tan\theta)$ |
| Option C: | $log(sec\theta)$ |
| Option D: | $log(cot\theta + tan\theta)$ |
| | |
| 7. | If $tan(x + iy) = i$ , then the value of y is |
| Option A: | log 2 |
| Option B: | $\frac{1}{4}\log log\ 2$ |
| Option C: | indeterminate |
| Option D: | $\infty$ |
| | |
| 8. | Imaginary part of Log (3 +4i) is |
| Option A: | $tan^{-1}\left(\frac{4}{3}\right)$ |
| Option B: | log 5 |
| Option C: | $tan^{-1}\left(\frac{4}{3}\right) + 2n\pi$ |
| Option D: | $tan^{-1}\left(\frac{4}{3}\right) + 2\pi$ |
| | |
| 9. | If PAQ is in the normal form of A, where A is a non -singular square matrix of order 3, then $A^{-1}$ will be , |
| Option A: | PQ |
| Option B: | QP |
| Option C: | $Q^{-1}P^{-1}$ |
| Option D: | $P^{-1}Q^{-1}$ |
| | |
| 10. | The rank of a Unitary matrix of order n is |
| Option A: | n - 1 |
| Option B: | n +1 |
| Option C: | n |
| Option D: | n + 2 |
| | |
| 11. | Find for which value of λ and μ the simultaneous equations x+y+z = 6, x+2y+3z = 10, x+2y+ λz = μ have infinite number of solution |
| Option A: | $\lambda = 3 , \mu = 10$ |
| Option B: | $\lambda \neq 3, \mu = 10$ |
| Option C: | $\lambda = 3 , \mu\ can\ take\ any\ value$ |
| Option D: | $\lambda = 3 , \mu \neq 10$ |
| | |
| 12. | For which value of λ the following system of equations 3x + y – λz = 0 , 4x - 2y -3z = 0 , 2 λ x + 4 y + λ z = 0 have non-trivial solution ? |
| Option A: | $\lambda \neq -9\ and\ \lambda = 1$ |
| Option B: | $\lambda = -9\ and\ \lambda = 1$ |
| Option C: | $\lambda = -9\ and\ \lambda \neq 1$ |
| Option D: | $\lambda = 9\ and\ \lambda = 1$ |

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| 13. | If $u = e^{\frac{x}{y}}$ , then find the value of $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2}$ is |
| Option A: | 1 |
| Option B: | $\frac{1}{2}$ |
| Option C: | -1 |
| Option D: | 0 |
| | |
| 14. | If z = f(x,y) and $x = uv,\ y = \frac{u}{v}$ , then the value of $\frac{\partial z}{\partial u}$ will be given by |
| Option A: | $v\frac{\partial z}{\partial x} - \frac{1}{v}\frac{\partial z}{\partial y}$ |
| Option B: | $\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y}$ |
| Option C: | $v\frac{\partial z}{\partial x} + \frac{1}{v}\frac{\partial z}{\partial y}$ |
| Option D: | $v\frac{\partial z}{\partial x} + u\frac{\partial z}{\partial y}$ |
| | |
| 15. | If $z = \log log\, r\,,\ r = x^2 + y^2$ then find the value of $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y}$ |
| Option A: | -2 |
| Option B: | 2 |
| Option C: | 2r |
| Option D: | $\frac{1}{r}$ |
| | |
| 16. | If $z = \frac{x}{y} + \frac{y}{x}$ , then the value of $\frac{\partial^2 z}{\partial x \partial y}$ is |
| Option A: | $-\frac{1}{x^2} - \frac{1}{y^2}$ |
| Option B: | $-\frac{1}{x^2}$ |
| Option C: | $-\frac{1}{y^2}$ |
| Option D: | $\frac{1}{x^2} + \frac{1}{y^2}$ |
| | |
| 17. | If y = $\sin^2$x , find $y_{10}$ |
| Option A: | $-2^9\cos 2x$ |
| Option B: | $2^9\cos 2x$ |
| Option C: | $2^9\sin 2x$ |
| Option D: | $-2^9\sin 2x$ |
| | |
| 18. | If y = $x^n$ log x , then $y_{n+1}$ is |
| Option A: | n! x |
| Option B: | n! log x |
| Option C: | $\frac{n!}{x}$ |
| Option D: | n ! |
| | |
| 19. | If $\left(1 + x^2\right) y_2 = 1$ , then choose the correct option |

| | |
|---|---|
| Option A: | $\left(1 + x^2\right) y_{n+2} + 2nx\, y_{n+1} + n(n - 1)y_n = 0$ |
| Option B: | $y_{n+2} + 2nx\, y_{n+1} - n(n - 1)y_n = 0$ |
| Option C: | $y_{n+2} - 2nx\, y_{n+1} + n(n - 1)y_n = 0$ |
| Option D: | $y_{n+2} + 2nx\, y_{n+1} + n^2 y_n = 0$ |
| | |
| 20. | The stationary values for $f(x, y) = xy(3 - x - y)$ are |
| Option A: | (0,0) , (3,0) , (1,1) , (1,-1) |
| Option B: | (0,0) , (0,3) , (3,0) , (1,1) |
| Option C: | (0,0) , (0,-3) , (3,3) , (1,1) |
| Option D: | (0,0) , (0,-3) , (3,0) , (1,1) |

| **Q2 . (20 Marks )** | **Solve any Four out of Six** **5 marks each** |
|---|---|
| A | If $\cos\cos 6\theta = a\,cos^6\theta + b\,cos^4\theta\,sin^2\theta + c\;cos^2\theta\,sin^4\theta + d\,sin^6\theta$ , find a,b,c,d. |
| B | If $\log log\ \sin sin\,(x + iy) = a + ib$ , prove that<br>i) $2e^{2a} = \cosh cosh\,2y - \cos cos\,2x$<br>ii) $\tan tan\,b = \cot cot\,x\,\tan tan\,hy$ |
| C | Find the non singular matrices P and Q such that PAQ is in the normal form and hence find Rank of the following matrix<br>A = $[2\;1\;1\;1\;0\;1\;3\;1\;2\quad 3\;2\;5\,]$ |
| D | Find a,b,c and A[-1] if A = $[1\;2\;a\;2\;1\;b\;2\;\;-2\;c\,]$ is orthogonal. |
| E | Divide 24 into 3 parts such that the continued product of the first, square of second and cube of the third is maximum using Lagrange's method. |
| F | If $u = f\left(x^2 - y^2,\ y^2 - z^2,\ z^2 - x^2\right)$, then prove that<br>$\frac{1}{x}\frac{\partial u}{\partial x} + \frac{1}{y}\frac{\partial u}{\partial y} + \frac{1}{z}\frac{\partial u}{\partial z} = 0$ |

| **Q3. (20 Marks )** | **Solve any Four out of Six** **5 marks each** |
|---|---|
| A | Find the continued product of the roots of $x^4 = 1 + i$ |
| B | Prove that $2e^{2x} = 2v - \cos cos\,2u$ , where<br>$e^z = \sin sin\,(u + iv)\ and\ z = x + iy$ |
| C | Express the matrix $[1 + 2i\;2\;3 - i\;2 + 3i\;2i\;1 - 2i\;1 + i\;0\;3 + 2i\,]$ as P+iQ , where both P and Q are Hermitian. |
| D | If $x = \cos cos\,h\left(\frac{1}{m}\log log\,y\right)$ , then prove that<br>$\left(x^2 - 1\right)y_{n+2} + (2n + 1)xy_{n+1} + \left(n^2 - m^2\right)y_n = 0$ |
| E | If $u = \log log\,r\ ,\ and\ r^2 = x^2 + y^2$ , then prove that<br>$x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} + 1 = 0$ |

| | |
|---|---|
| F | If $u = \log log \frac{x+y}{\sqrt{x^2+y^2}} + sin^{-1}\frac{x+y}{\sqrt{x}+\sqrt{y}}$ , prove that<br>$x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = -\frac{sin\, w\, coscos\, 2w}{4cos^3 w}$ ,<br>where $w = sin^{-1}\frac{x+y}{\sqrt{x}+\sqrt{y}}$ |

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Curriculum Scheme: Rev2019

Examination: First Year Semester I

Course Code: _FEC101____ and Course Name: _EM-I___

Time: 2 hours Max. Marks: 80

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| Question Number | Correct Option (Enter either 'A' or 'B' or 'C' or 'D') |
|---|---|
| Q1. | D |
| Q2. | A |
| Q3 | D |
| Q4 | A |
| Q5 | C |
| Q6 | B |
| Q7 | D |
| Q8 | C |
| Q9. | B |
| Q10. | C |
| Q11. | A |
| Q12. | B |
| Q13. | D |
| Q14. | C |
| Q15. | B |
| Q16. | A |
| Q17. | B |
| Q18. | C |
| Q19. | A |
| Q20. | B |