# University of Mumbai
# SAKEC Chembur
## Sample Question Paper

Program: ECS and EXTC
Curriculum Scheme: Rev 2019 'C' Scheme
Examination: SE Semester III
Course Code: ECC301 and Course Name: Engineering Mathematics III

Time: 2.30 hour                    Max. Marks: 80

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|---|---|
| **Q1. (20 Marks)** | **Choose the correct option for following questions. All the Questions are compulsory and carry equal marks** |
| 1 | The Laplace Transform of $t.e^{at}$ |
| Option A: | $\frac{1}{s}$ |
| Option B: | $\frac{1}{(s-a)^2}$ |
| Option C: | $\frac{1}{(s+a)^2}$ |
| Option D: | $\frac{1}{s^2}$ |
| | |
| 2 | Find $L\left(\frac{e^{-t}\sin t}{t}\right)$ |
| Option A: | $\cot^{-1}(s+1)$ |
| Option B: | $\tan^{-1}(s+1)$ |
| Option C: | $\tan^{-1}(s-1)$ |
| Option D: | $\cot^{-1} s$ |
| | |
| 3 | Given $f(t)=\frac{\sin t}{t}$, find $L\{f'(t)\}$ |
| Option A: | $s\cot^{-1} s$ |
| Option B: | $s\cot^{-1} s+1$ |
| Option C: | $\tan^{-1} s-1$ |
| Option D: | $s\cot^{-1} s-1$ |
| 4 | Find $L^{-1}\left[\frac{s+2}{s^2+4s+7}\right]$ |
| Option A: | $e^{-2t}.\cos\sqrt{3}t$ |
| Option B: | $e^{-2t}.\cos\sqrt{2}t$ |
| Option C: | $e^{-2t}.\cos^2 t$ |

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|---|---|
| Option D: | $e^{-2t}.\sin\sqrt{3}t$ |
| | |
| 5 | $$\int_S \bar{N}\cdot(\nabla\times\bar{F})ds=\int_C \bar{F}\cdot d\bar{r}$$ Where N is the unit outward normal vector to the element ds is |
| Option A: | Stoke's Theorem |
| Option B: | Green's Theorem |
| Option C: | Gauss-Divergence Theorem |
| Option D: | Pythagoreans Theorem |
| | |
| 6 | Find the Inverse Laplace transform of $\frac{1}{s.(s+a)}$ |
| Option A: | $\frac{1+e^{-at}}{a}$ |
| Option B: | $e^{-at}$ |
| Option C: | $e^{-at}+1$ |
| Option D: | $\frac{1-e^{-at}}{a}$ |
| | |
| 7 | If 1, 2 & 3 are eigen values of matrix A then eigen values of matrix $A^3$ are |
| Option A: | 1, 8 & 27 |
| Option B: | 1, 4 & 9 |
| Option C: | 2, 3 & 2 |
| Option D: | 0, 3 & 9 |
| | |
| 8 | In half range *sine* Fourier series, we assume the function to be |
| Option A: | Odd function |
| Option B: | Even function |
| Option C: | Both even and odd |
| Option D: | Can be anything |
| | |
| 9 | The Fourier co-efficient $a_n$ for the function $f(x)=x^2$ in $(0,2\pi)$ is given by |
| Option A: | $\frac{n}{4\pi}$ |
| Option B: | $\frac{3\pi}{n^2}$ |
| Option C: | $\frac{4\pi}{n}$ |
| Option D: | $\frac{3\pi}{n^3}$ |
| | |
| 10 | If $f(x) = \cos x$ defined in $(-\pi,\pi)$ then the value Fourier coefficient $b_n$ is |
| Option A: | 0 |
| Option B: | $\pi$ |

| | |
|---|---|
| Option C: | $\frac{\pi}{(n^2-1)}$ |
| Option D: | $\frac{2\pi}{(n^2-1)}[(-1)^n-1]$ |
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## Subjective / Descriptive questions

| **Q2 (20 Marks)** | **Solve any Four out of Six. 5 marks each** |
|---|---|
| A | Find the Laplace transform of $\cos t.\cos 2t.\cos 3t$ |
| B | Using convolution theorem find the Inverse Laplace transform of $\frac{s^2}{\left(s^2+a^2\right)^2}$ |
| C | Find the Fourier expansion of $f(x)=x+x^2;\ -\pi\le x\le\pi$ and $f(x+2\pi)=f(x)$ |
| D | Find Fourier series for $f(x)=x^2$ in $(0,2\pi)$ |
| E | Find an analytic function $f(z)$ whose imaginary part is $e^{-x}\left(y\sin y+x\cos y\right)$ |
| F | Show that $\bar{F}=(y^2-z^2+3yz-2x)i+(3xz+2xy)j+(3xy-2xz+2z)k$ is both solenoidal and irrotational. |

| **Q3 (20 Marks)** | **Solve any Four out of Six. 5 marks each** |
|---|---|
| A | By using Laplace transform, evaluate $\int_0^{\infty} e^{-t}\left(\frac{\cos 3t-\cos 2t}{t}\right).dt$ |
| B | Find the inverse Laplace transform of $\tan^{-1}\left(\frac{2}{s^2}\right)$ |
| C | Find the orthogonal trajectory of the family of curves $x^3y-xy^3=c$ |
| D | Find half range cosine series for *f(x)=x* in (0,2). |
| E | Obtain the expansion of $f(x)=x(\pi-x);\ 0<x<\pi$ as a half-range cosine series. |
| F | Is the matrix $A$ is diagonalizable?<br>If diagonalizable find diagonalizing matrix P and diagonal matrix D<br>A=$\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ |

| **Q4** **(20 Marks)** | **Solve any Four out of Six. 5 marks each** |
|---|---|
| A | Find the eigen values & eigen vectors for the matrix $A = \begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ |
| B | Show that $u = x^3y - xy^3$ is a harmonic function. Find its harmonic conjugate and analytic function |
| C | If $\bar{F} = (axy + bz^3)\mathrm{i} + (3\mathrm{x}^2 - \mathrm{cz})\mathrm{j} + (3\mathrm{xz}^2 - \mathrm{y})\mathrm{k}$ is irrotational, find the value of a, b & c. |
| D | Find $L\left[\frac{\sin^2 t}{t}\right]$ |
| E | Find $L^{-1}\left[\frac{s^2}{(s+a)^2}\right]$ using convolution theorem |
| F | Evaluate by Green's theorem $\int_C (x^2 - xy)dx + (x^2 - y^2)dy$ where C is the closed curve bounded by $x^2 = 2y$ and $x = y$ |