B. E. First Semester (ALL)/SOE_18-19_Rev_FY-201 Examination

Course Code : GE 2102 **Course Name : Engineering Mathematics–II**

Time : 2 Hours] [Max. Marks : 40

Instructions to Candidates :—

(1) Attempt any **Four** questions out of **Six**.
(2) All questions carry **Ten** marks.
(3) Assume suitable data wherever necessary.
(4) All questions carry marks as indicated.
(5) Use of Logarithmic tables, non – programmable calculator, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.

1. Attempt Q. 1(A) or Q. 1(B) :

(A) (A1) Solve $(1+x^2)\dfrac{dy}{dx} + y = e^{\tan^{-1}x}$ 4(CO1)

(A2) Solve (CO1) $\dfrac{d2y}{dx2} + 5\dfrac{dy}{dx} + 6y = e^{-2x} + \sin x$ 6(CO1)

OR

(B) (B1) Solve $[\cos x \tan y + \cos(x+y)]\,dx$
$+[\sin x \sec^2 y + \cos(x+y)]dy = 0$ 4(CO1)

(B2) Solve by the method of variation of parameters.
$\dfrac{d^2y}{dx^2} - 6\dfrac{dy}{dx} + 9y = \dfrac{e^3x}{x^2}$ 6(CO1)

2. Attempt Q. 2(A) or Q. 2(B) :

(A) (A1) Solve $x^2\dfrac{d^2y}{dx^2} - x\dfrac{dy}{dx} + 4y = \cos(\log x) + x\sin(\log x)$ 4(CO1)

(A2) Solve $\dfrac{dx}{dt} + y = \sin t,\ \dfrac{dy}{dt} + x = \cos t$ 6(CO1)

OR

(B) (B1) Solve $(x+1)^2 \dfrac{d^2y}{dx^2} + (x+1) \dfrac{dy}{dx} = 2\sin\{\log(1 + x)\}$ 4(CO1)

(B2) When a resistance R ohms is connected in series with an inductance L henneries and an E. M. F. of E volts, the current I amperes at time t is given by :

$$L \frac{di}{dt} + Ri = E$$

If $E = E_0 \sin t$ volts and $i = 0$ when $t = 0$, find current I as a function of time t. 6(CO1)

3. Attempt Q. 3(A) or Q.3(B) :

(A) (A1) Separate $\tan^{-1}(x + iy)$ into real and imaginary part. 5(CO2)

(A2) If $\sin(\alpha + i\beta) = x + iy$ then prove that

(a) $\dfrac{x^2}{\cosh^2\beta} + \dfrac{y^2}{\sinh^2\beta}$

(b) $\dfrac{x^2}{\sin^2\alpha} - \dfrac{y^2}{\cos^2\alpha} = 1$ 5(CO2)

OR

(B) (B1) Find the smallest positive integer n for which $\left[\dfrac{1+i}{1-i}\right]^n = 1.$ 5(CO2)

(B2) Find the general value of $\log(-3)$. 5(CO2)

4. Attempt Q. 4(A) or Q. 4(B) :

(A) (A1) Show that the function $u = \dfrac{1}{2} \log (x^2 + y^2)$ is harmonic, And find its harmonic conjugate. 5(CO2)

(A2) Find the Taylors series expansion of

$$f(z) = \frac{2z^3 + 1}{(z^2 + z)} \text{ about } z = 1$$ 5(CO2)

OR

(B) (B1) Evaluate $\oint_C \frac{12z - 7}{(z - 1)(2z + 3)} dz$, where c is circle $|z| = 2$. 5(CO2)

(B2) Evaluate $\int_0^{\pi} \frac{d\theta}{3+2\cos}$ by contour Integration. 5(CO2)

5. Attempt Q.5(A) Q. 5(B) :

(A) (A1) Test the consistency and Solve

$5x + 3y + 7z = 4$, $3x + 26y + 2z = 9$, $7x + 2y + 10z = 5$. 4(CO3)

(A2) Use Cayley Hamilton Theorem to find A^{-1} for the following matrix

$$A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$ 6(CO3)

OR

(B) (B1) For the Matrix $A = \begin{bmatrix} 3 & 4 \\ -1 & 4 \end{bmatrix}$ construct a modal matrix B. 4(CO3)

(B2) Using Sylvester's theorem, Show that $3\tan A = (\tan 3)A$,

where $A = \begin{bmatrix} -1 & 4 \\ 2 & 1 \end{bmatrix}$ 6(CO3)

6. Attempt Q. 6(A) or Q. 6(B) :

(A) (A1) Fit an equlation of the form $y = ax^b$ to the following data:

x	1	2	3	4	5
y	0.5	2	4.5	8	12.5

4(CO4)

(A2) Find the equation of regression lines and the coefficient of correlation for the following data :

x	3	5	6	8	9	11
y	2	3	4	6	5	8

6(CO4)

(B) (B1) The marks secured by recruits in selection test and proficiency test are given below :

Selection Test	68	64	75	50	64	80	75	40	55	64
Proficiency Test	62	58	68	45	81	60	68	48	50	70

Find rank of correlation coefficient. 4(CO4)

(B2) Two lines of regression are given by $5y - 8x + 17 = 0$ and

$2y - 5x + 14 = 0$

If $\sigma_y^2 = 16$, find

(i) Mean values of x and y.

(ii) The coefficient of correlation between x and y.

(iii) The standard deviation of x

(iv) Variance of x. 6(CO4)