USN

Second Semester B.E. Degree Examination, Aug./Sept.2020
Engineering Mathematics – II

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, selecting ONE full question from each module.***

Module-1

1 a. Solve $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$. **(06 Marks)**

b. Solve $y'' - 4y' + 4y = e^x$. **(07 Marks)**

c. Solve $\frac{d^2y}{dx^2} + y = \tan x$ by the method of variation of parameters. **(07 Marks)**

2 a. Solve $(D^2 - 2D + 5)y = (\sin x)$. **(06 Marks)**

b. Solve $y'' + 2y' + y = 2x + x^2$. **(07 Marks)**

c. Solve by the method of undeterminant coefficient $(D^2 + 1)y = x^2$. **(07 Marks)**

Module-2

3 a. Solve $\frac{dx}{dt} + 2y = -\sin t$, $\frac{dy}{dt} - 2x = \cos t$. **(07 Marks)**

b. Solve $(1+x)^2 y'' + (1+x)y' + y = \sin 2[\log(1+x)]$. **(07 Marks)**

c. Solve $y\left(\frac{dy}{dx}\right)^2 + (x-y)\frac{dy}{dx} - x = 0$. **(06 Marks)**

4 a. Solve $x^3y''' + 3x^2y'' + xy' + 8y = 65\cos(\log x)$. **(07 Marks)**

b. Obtain the general solution of $x^2p^4 + 2xp - y = 0$. **(07 Marks)**

c. Show that the equation $xp^2 + px - py + 1 - y = 0$ is Clairaut's equation. Hence obtain the general solution. **(06 Marks)**

Module-3

5 a. Form the partial differential equation by eliminating the arbitrary functions ϕ and Ψ from the relation $Z = \phi(x + ay) + \psi(x - ay)$. **(06 Marks)**

b. Derive one dimensional heat equation. **(07 Marks)**

c. Evaluate $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z}\, dxdydz$. **(07 Marks)**

6 a. Solve the partial differential equation $\frac{\partial^2 u}{\partial x^2} = x + y$ by direct integration. **(06 Marks)**

b. Derive one dimensional wave equation. **(07 Marks)**

c. Evaluate $\iint_R (x^2 + y^2)dxdy$ where R is the region bounded by the lines y= 0, y = x and x = 1. **(07 Marks)**

Module-4

7 a. Using multiple integrals, find the area bounded by the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$. **(06 Marks)**

b. Prove that $\beta(m,n)=\frac{\Gamma(m)\,\Gamma(n)}{\Gamma(m+n)}$ **(07 Marks)**

c. Express the vector $\vec{F}=2y\hat{i}-z\hat{j}+3x\hat{k}$ in cylindrical coordinates. **(07 Marks)**

8 a. Find the area bounded between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ using double integration. **(06 Marks)**

b. Show that $\int_0^{\pi/2}\frac{d\theta}{\sqrt{\sin\theta}}\times\int_0^{\pi/2}\sqrt{\sin\theta}\,d\theta=\pi$. Using Beta and Gamma functions. **(07 Marks)**

c. Prove that the cylindrical coordinate system orthogonal. **(07 Marks)**

Module-5

9 a. Find the Laplace transform of $\frac{\cos at-\cos bt}{t}$. **(06 Marks)**

b. Find the Laplace transform of

$$\begin{cases}1, & 0<t\le 1\\ t, & 1<t\le 2\\ t^2, & t>2\end{cases}$$

(07 Marks)

c. Using convolution theorem, find the inverse Laplace transform of $\frac{s}{(s^2+a^2)^2}$. **(07 Marks)**

10 a. Find the inverse Laplace transform of $\frac{s+5}{s^2-6s+13}$. **(06 Marks)**

b. Given $f(t)=\begin{cases}E, & 0<t<a/2\\ -E, & a/2<t<a\end{cases}$ where $f(t+a)=f(t)$, show that $L\{f(t)\}=\frac{E}{S}\tan h\left(\frac{as}{4}\right)$. **(07 Marks)**

c. Solve the differential equation $y''+4y'+3y=e^{-t}$ with $y(0) = 1 = y'(0)$ using Laplace transforms. **(07 Marks)**

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