VTU QUESTION PAPERS

MODULE - 1
DIFFERENTIAL EQUATIONS – I

1) $Solve\ 4\frac{d^4y}{dx^4}-4\frac{d^3y}{dx^3}-23\frac{d^2y}{dx^2}+12\frac{dy}{dx}+36=0$

(July 2015)

2) $Solve\frac{d^3y}{dx^3}+6\frac{d^2y}{dx^2}+11\frac{dy}{dx}+6y=e^x+1$ **July 201**5

3) $Solve\ \ 2\frac{d^2y}{dx^2}-2\frac{dy}{dx}=e^x\sin x$ **July 2015**

4) $Solve: y''+4y'-12y=e^{2x}-3\sin 2x$ Jan 2016

5) By the method of undetermined coefficients solve $y''+y=2\cos x$ (Jan 2016)

6) By the method of variation of parameters solve $y''+4y=\tan 2x$ (Jan 2016)

7) $Solve\ (D^4+m^4)y=0$ (Jan 2016)

8) $Solve\ (D^4+m^4)y=0$ (Jan 2016)

9) Solve $(D^2+7D+12)y=\cosh x$ *Jan* 2016

10) *By the method of variation of parameters solve* $y''+y=x\sin x$ 9) *Jan* 2016

11) $Solve(4D^4-8D^3-7D^2+11D+6)y=0$ (June 2015)

12) $Solve(D^2+4)y=x^2+e^{-x}$ (June 2015)

13) $Solve(D^2-2D+2)y=e^x\tan x$ using *method of* var*iation of parameters.* (June 2015)

14) Solve $(D^3-D)y=2e^x+4\cos x$ (Jan 2015)

15) Solve: (D^2+2)**y=** $x^2e^{3x}+e^x\cos 2x$ **(Jan 2015)**

16) Solve the simultaneous equation (D+5) x-2y=t and (D+1) y+2x=0 (Jan2015)

17) Solve $(D-2)^2 y=8\ e^{2x}+\sin 2x$ (June 2014)

18) Solve: $y''-2y'+y=x\cos x$ (June 2014)

19) Solve $\frac{dx}{dt}-7x+y=0,\ \frac{dy}{dt}-2x-5y=0$ (June 2014)

20) Solve $\frac{dx}{dt}-2y=\cos 2t,\ \frac{dy}{dt}+2x=\sin 2t,\ \textit{given that } x=1, y=0 \textit{ at } t=0$ (Dec2013)

21) Using the method of variation of variation of parameters solve $y''-6y'+9y=\frac{e^{3x}}{x^2}$.
(June 2014, Dec 2013)

22) Solve: $x^2y''+xy'+y=2\cos^2(\log x)$. (Dec 2013)

MODULE-2

DIFFERENTIAL EQUATIONS - II

1) Solve the simultaneous equations $\frac{dx}{dt}+2y+\sin t=0,\ \frac{dy}{dt}-2x-\cos t=0$ given that x = 0, y = 1 when t = 0 (Jan 2016)

2) Solve $x^2y''-xy'+2y=x\sin(\log x)$ (Jan 2016)

3) Solve $\frac{dy}{dx}-\frac{dx}{dy}=\frac{x}{y}-\frac{y}{x}$ (Jan 2016, June 2015)

4) *Solve* $(x+a)^2y''-4(x+a)y'+6y=x$ (July 2015)

5) Solve $p=\tan\left(x-\frac{p}{1+p^2}\right)$ (Jan 2016)

6) Find the general and singular solution of the equation $y=px+p^3$ (Jan 2016)

7) *Solve* $(px-y)(py+x)=a^2p$ *by reducing to Clairaut's equation.* (June 2015)

8) *Solve* $(1+x)^2y''+(1+x)y'+y=2\sin(\log x)$ (June 2015)

9) *Solve* $y=2px+y^2p^3$ *by solving for* x. (June 2015)

10) *Solve* $x^2\frac{d^2y}{dx^2}+4x\frac{dy}{dx}+2y=e^x$ (June 2015)

11) *Solve* $\frac{dx}{dt}-7x+y=0,\ \frac{dy}{dt}-2x-5y=0$ (June 2015)

12) Solve $p^2-4x^5p-12x^4y=0$, obtain the singular solution also.. (Jan 2015)

13) *Solve* $(px-y)(py+x)=2p$, by reducing into Clairaut's form,taking the substitution $X=x^2, Y=y^2$. (Jan 2015)

14) Solve $p^3-4xyp+8y^2=0$ by solving for x.. (Jan 2015)

15) Solve $p(p+y)=x(x+y)$ (June 2014)

16) Obtain the general solution and singular solution of the equation $y=2px+p^2y$. (June 2014)

17) Obtain the general solution and singular solution of the Clairaut's equation $xp^3 - yp^2 + 1 = 0$.
(Dec 2013)

18) Solve $p^2 + 2py\cot x = y^2$. (Dec 2013)

MODULE 3

PARTIAL DIFFERENTIAL EQUATION

1) Form the partial differential equation of Z = y f(x) + xg(y) where f and g are arbitrary functions. (Jan 2016)

2) Derive one dimensional heat equation as $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$. (Jan 2016, July 2015)

3) From the function f(x^2+ y^2 , z-xy) = 0 form the partial differential equation . (July 2015)

4) Derive one dimensional wave equation as $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$. (July 2015)

.

5) Solve $z_{xy} = \sin x \sin y$ *for which* $z_y = -2\sin y$ *when* $x = 0$ *and* $z = 0$

when y is an odd multiple of $\frac{\pi}{2}$. (Jan 2015)

6) Solve: $x^2 - y^2 - z^2 \;\; P + 2xyq = 2xz$ (Jan 2015)

7) Solve by the method of variables $3u_x + 2u_y = 0, \textit{given that } u(x,0) = 4e^{-x}$ (Jan 2015)

8) Form the partial differential equation by eliminating the arbitrary functions from
z = f(y-2x)+g(2y-x) (June 2014)

9) Solve: $x^2 - yz \;\; P + \;\; y^2 - zx \;\; q = z^2 - xy$ (June 2014, Dec 2013)

10) Solve by the method of variables $4\frac{\partial u}{dx} + \frac{\partial u}{\partial y} = 3u, \textit{given that } u(0,y) = 2e^{5y}$

(Jan 2015, June2014)

11) Solve $\frac{\partial^2 z}{\partial x^2} + z = 0 \textit{ given that when } x = 0, z = e^y \textit{ and } \frac{\partial z}{\partial x} = 1$ (Dec 2013)

MODULE-4
INTEGRAL CALCULUS

1) $Evaluate \int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a} x^2 + y^2 + z^2 \ dxdydz$ (Jan 2016)

2) $Solve \ \frac{\partial^2 z}{\partial x \partial y} = Sinx \sin y, \ for\ which \ \frac{\partial z}{\partial y} = -2\sin y \ \ when \ x = 0 \ and \ z = 0$

$when \ y \ is \ an \ odd \ multiple \ of \ \frac{\pi}{2}$ Jan 2016, $July$ 2015

3) Evaluate $\iint_R xy \, dx \, dy$, where R is the region bounded by x- axis, the ordinate x=2a and the parabola $x^2=4ay$. (Jan 2016)

4) Evaluate $\int_0^\infty\int_0^\infty e^{-(x^2+y^2)} \, dx \, dy$ by changing into polar coordinates. (Jan 2016)

5) Evaluate $\int_0^1\int_{x^2}^{2-x} xy \, dy \, dx$ changing the order of integration. (July 2015)

6) Evaluate $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z} x + y + z \ \ dy \, dx \, dz$. (July 2015)

7) Find the area between the parabolas $y^2=4ax$ and $x^2 = 4ay$ (July 2015)

. 8) $Evaluate$ $\int_0^1 \frac{dx}{\sqrt{1-x^4}}$ using $beta \ and \ gamma \ function$ (June 2015)

9) Show that $\int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{\sin\theta}} \times \int_0^{\frac{\pi}{2}} \sqrt{\sin\theta} \, d\theta = \pi$

(June 2015)

10) Evaluate $\int_0^b \int_0^{\frac{a}{b}\sqrt{b^2-y^2}} xy \, dxdy$ by changing the order of integration (Jan 2015, June2014)

Solution:

11) Evaluate $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)dy\,dx\,dz$ (Jan 2015)

12) Show that $\int_{-1}^{1}(1+x)^{p-1}(1-x)^{q-1}dx = 2^{p+q-1}\beta(m,n)$ (Jan 2015, Dec 2013)

13) Prove that $B(m,n) = \int_{0}^{1}\frac{x^{m-1}+x^{n-1}}{(1+x)^{m+n}}dx$ (June 2014)

14) Change the order of integration in $\int_{0}^{1}\int_{0}^{\sqrt{1-x^2}} y^2\,dxdy$ and hence evaluate the same.

(June 2014)

15) Evaluate $\int_{0}^{a}\int_{0}^{x}\int_{0}^{x+y} e^{x+y+z}\,dzdydx.$ (June 2014)

16) Change the order of integration in $\int_{0}^{1}\int_{y=x^2}^{2-x} xy\,dxdy$ *and evaluate the same*

(Dec 2013)

17) Evaluate $\int_{0}^{\infty}\int_{0}^{\infty} e^{-(x^2+y^2)}\,dxdy$ *by changing to polar coordinates*

(Dec 2013)

MODULE-5
LAPLACE TRANSFORMS

1) Find $L\left[e^{-2t}\sin 3t + e^{t}t\cos t\right]$. (Jan 2016)

2) Find the inverse Laplace transform of $\dfrac{4s+5}{(s-1)^2(s+2)}$. (Jan 2016)

3) Solve $y''+6y'+9y=12t^2e^{-3t}$ by Laplace transform method with y(0) = 0 =y^1(0). (Jan 2016)

4) Express $f(t)=\begin{cases}\cos t, 0<t\le\pi \\ 1 \quad ,\pi<t\le 2\pi \\ \sin t, t>2\pi\end{cases}$ in terms of unit step function and hence find its Laplace transform . (Jan 2016)

5) Solve $y''+6y'+9y=12t^2e^{-3t}$ by Laplace transform method with y(0) = 0 =y^1(0). (Jan 2016)

6) Find $L\left\{\dfrac{\cos at-\cos bt}{t}\right\}$ (Jan 2016)

7) Find the Laplace transform of $te^{-4t}\sin 3t$ *and* $\dfrac{e^{at}-e^{-at}}{t}$ (July 2015)

8) Express f(t) in terms of unit step function and find its Laplace transform given that

$$f(t)=t\begin{cases}t^2, 0<t<2 \\ 4t, 2<t<4 \\ 8 \ , t>4\end{cases}$$ (July 2015)

9) Find $L^{-1}\left\{\dfrac{1}{(s+1)(s^2+9)}\right\}$ using convolution theorem. (July 2015)

10) A periodic function f(t) with period 2 is defined by $f(t)=\begin{cases}t \quad ,0<t<1 \\ 2-t, 1<t<2\end{cases}$ find L{f(t)} (July 2015)

11) Find $L^{-1}\left\{\frac{5s-2}{3s^2+4s+8}+\log\left(\frac{1}{s^2}-1\right)\right\}$ (July 2015)

12) Solve using Laplace transform method $\frac{d^2y}{dt^2}+2\frac{dy}{dt}+y=te^{-t}$ *with* $y(0)=1, y'(0)=-2$

(July 2015)

13) *Find* $L\ t(\sin^3 t-\cos^3 t)$ (Jan 2015)

14) Express f(t) in terms of unit step function and hence find the Laplace transform (Jan 2015)

given that $f(t)=\begin{cases} t^2 & 0<t<2 \\ 4t & 2<t<4 \\ 8 & t>4 \end{cases}$

15) Find the value of $\int_0^\infty t^3 e^{-t}\sin t\,dt$ using Laplace transforms (Jan 2015)

16) Find Laplace transform of a periodic function $f(t)=\begin{cases} t, & 0<t<\pi \\ \pi-t, & \pi<t<2\pi \end{cases}$ (Jan 2015)

17) Prove that L $\delta(t-a)\ = e^{-as}$ (June 2014)

18) *If* $f(t)=\begin{cases} t, & 0\le t\le a \\ 2a-t, & a\le t\le 2a \end{cases}$, *where* $f(t+2a)=f(t)$, *show that* $L\ \ f(t)\ =\frac{E}{s}\tanh\left(\frac{as}{2}\right)$

Laplace transform (June 2014)

19) *Find the inverse Laplace transform of* $\tan^{-1}(2/s^2)$ (June 2014)

20) *Find* $L^{-1}\left[\frac{S}{(s-1)(s^2+4)}\right]$ *using convolution theorem* (June 2014)

21) Solve the following initial value problem by using Laplace transforms:

$\frac{d^2y}{dt^2}+4\frac{dy}{dt}+4y=e^{-t};\ y(0)=0, y'(0)=0$

(June 2014)

22) Find L $L^{-1}\left\{\frac{5s+3}{(s-1)(s^2+2s+5)}\right\}$

(Dec 2013)

23) *Using convolution theorem evaluate* $L^{-1}\left\{\dfrac{s^2}{(s^2+a^2)(s^2+a^2)}\right\}$

(Dec 2013)

24) *Solve* $y''' + 2y'' - y' - 2y = 0$ *given* $y(0) = y'(0) = 0$ *and* $y''(0) = 6$ *by using Laplace transform method*

(Dec 2013)

25) Solve the initial value problem $(D^3 - 3D^2 + 3D - 1)y = 2t^2e^t,\ y(0) = 1,\ y'(0) = 0,\ y''(0) = -2$

Dec 2013