VTU QUESTION PAPERS

MODULE - 1
DIFFERENTIAL EQUATIONS – I

1) *Solve* $4\frac{d^4y}{dx^4} \quad 4\frac{d^3y}{dx^3} \quad 23\frac{d^2y}{dx^2} \quad 12\frac{dy}{dx} \quad 36 \quad 0$ (July 2015)

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

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

4) *Solve*: $y \quad 4y \quad 12y \quad e^{2x} \quad 3\sin 2x$ Jan 2016

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

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

7) *Solve* $(D^4 \quad m^4)y \quad 0$ (Jan 2016)

8) *Solve* $(D^4 \quad m^4)y \quad 0$ (Jan 2016)

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

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

11) *Solve* $(4D^4 \quad 8D^3 \quad 7D^2 \quad 11D \quad 6)y \quad 0$ (June 2015)

12) *Solve* $(D^2 \quad 4)y \quad x^2 \quad e^x$ (June 2015)

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

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

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

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

17) Solve $(D \quad 2)^2 y \quad 8 \; e^{2x} \quad \sin 2x$ (June 2014)

18) Solve: $y \quad 2y \quad y \quad x \cos x$ (June 2014)

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

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

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

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

MODULE-2

DIFFERENTIAL EQUATIONS - II

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

2) Solve $x^2 y \quad xy \quad 2y \quad x \sin \log x$ (Jan 2016)

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

4) *Solve* $x \quad a^{2} y \quad 4 \ x \quad a \ y \quad 6y \quad x$ (July 2015)

5) Solve $p \quad \tan \ x \quad \frac{p}{1 \quad p^2}$ (Jan 2016)

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

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

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

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

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

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

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

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

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

15) Solve $p(p \quad y) \quad x(x \quad y)$ (June 2014)

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

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

18) Solve $p^2 \quad 2py\cot x \quad y^2$. (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)

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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 $3u_x + 2u_y = 0$, *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 $4\frac{\partial u}{dx} + \frac{\partial u}{\partial y} = 3u$, *given that* $u(0, y) = 2e^{5y}$

(Jan 2015, June2014)

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

MODULE-4

INTEGRAL CALCULUS

1) Evaluate $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}\left(x^2+y^2+z^2\right)dx\,dy\,dz$ (Jan 2016)

2) Solve $\frac{\partial^2 z}{\partial x\,\partial y}=\sin x\sin y$, 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 $\int_0^{\pi/2}\frac{d\theta}{\sqrt{\sin\theta}}\times\int_0^{\pi/2}\sqrt{\sin\theta}\,d\theta=\pi$ (June 2015)

10) Evaluate $\int_0^{b}\int_0^{\frac{a}{b}\sqrt{b^2-y^2}} xy\,dx\,dy$ 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 $\int_{0}^{1}\int_{0}^{\sqrt{1-x^2}}y^2\,dx\,dy$ and hence evaluate the same.

(June 2014)

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

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

(Dec 2013)

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

(Dec 2013)

MODULE-5
LAPLACE TRANSFORMS

1) Find $L\ e^{\ 2t} \sin 3t \quad e^{t} t \cos t$. (Jan 2016)

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

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

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

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

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

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

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

$$f(t) \quad t \quad \begin{matrix} t^{2}, 0 \quad t \quad 2 \\ 4t, 2 \quad t \quad 4 \\ 8, \mathrm{t} \quad 4 \end{matrix}$$ (July 2015)

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

10) A periodic function f(t) with period 2 is defined by $f(t) \quad \begin{matrix} t \quad , 0 \quad t \quad 1 \\ 2 \quad t, 1 \quad t \quad 2 \end{matrix}$ find L{f(t)}

(July 2015)

11) Find $L^{1}\ \dfrac{5s \quad 2}{3s^2 \quad 4s \quad 8} \quad \log \dfrac{1}{s^2} \quad 1$ (July 2015)

12) Solve using Laplace transform method $\dfrac{d^2y}{dt^2} \quad 2\dfrac{dy}{dt} \quad y \quad te^{\ t}$ $with\ y(0) \quad 1, y'(0) \quad 2$

(July 2015)

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

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

$$given\ that\ f(t) \quad \begin{matrix} t^2 & 0 \quad t \quad 2 \\ 4t & 2 \quad t \quad 4 \\ 8 & t \quad 4 \end{matrix}$$

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

16) Find Laplace transform of a periodic function $f(t) \quad \begin{matrix} t, & 0 \quad t \\ t, & t \quad 2 \end{matrix}$ (Jan 2015)

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

18) $If\ f(t) \quad \begin{matrix} t, & 0 \quad t \quad a \\ 2a \quad t, & a \quad t \quad 2a \end{matrix}, where\ f(t \quad 2a) \quad f(t), showthat\ L\ f(t) \quad \dfrac{E}{s}\tanh \dfrac{as}{2}$

Laplace transform (June 2014)

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

20) $Find\ L^{1}\ \dfrac{S}{(s \quad 1)(s^2 \quad 4)}$ *using convolution theorem* (June 2014)

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

$$\frac{d^2y}{dt^2} \quad 4\frac{dy}{dt} \quad 4y \quad e^{\ t};\ y(0) \quad 0, y\ (0) \quad 0$$

(June 2014)

22) Find L $L^{1}\ \dfrac{5s \quad 3}{s \quad 1\ s^2 \quad 2s \quad 5}$

(Dec 2013)

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

(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