Mid-Term Exams

Fayoum University | 1st Civil Eng. | Differential Equations
Faculty of Engineering | Mid -Term exam | Apr., 29, 2018
Examiner: Assoc. Prof. Karem Mahmoud | Time: 40 Min.

Choose the correct answer as this Figure ●

1. Find the degree and order of D.E: $\sin x + y^2 + y' = 3$				
	(A) 4, 3	(B) 3, 2	(C) 2, 1	(D) 1, 1
2. Find the independent variable in the code >> y=dsolve('Dy=y^3*exp(-2*x))				
	(A) y	(B) x	(C) t	(D) D
3. Solve the D.E: $y' = \sin^2(x-y+1), y(0) = -1,$				
	(A) $x - 1 - \tan^{-1}(x)$	(B) $x - \tan^{-1}(x+c)$	(C) $x - \tan^{-1}(x)$	(D) $x - \tan(x)$
4. $(2xy + \tan x)\, y' = -(y^2 + y/\cos^2 x)$ is ..... D.E:				
	(A) linear	(B) Bernoulli	(C) exact	(D) separable
5. $xy' + y = y^2 x^2$				
	(A) $1/(-x^2 - cx)$	(B) $1/(x^2 + cx)$	(C) $1/(x^2 - cx)$	(D) $(1+c)/x^2$
6. Find the resistance force in the mechanical system: $mg - kv^2 = m\, dv/dt$				
	(A) $-kv^2$	(B) mg	(C) kv^2	(D) $-mg - kv^2$
7. The problem: $y''' + 2xy'' + y' - y = x, y(0) = 1, y'(0) = -1, y''(0) = 0.$ is				
	(A) non-linear	(B) BVP	(C) IVP	(D) particular
8. Find the linearly dependent functions				
	(A) e^{-x}, e^x	(B) x, e^x	(C) x, 2x	(D) sinx, sin(2x)
9. Solve the D.E: $4y'' - 12y' + 5y = 0, y(0) = 0, y'(0) = 1.$				
	(A) $e^{x/2}(c - 2ce^{2x})$	(B) $e^{x/2}(1 - e^{2x})$	(C) $ce^{x/2}(1 - e^{2x})$	(D) $ce^{x/2}(1 + e^{2x})$
10. Find output of the code >> dsolve('D2y+y=2*t','y(0)=0','Dy(0)=1','t')				
	(A) sin(t)+2*t	(B) 2*sin(t)+t	(C) -sin(t)+2*t	(D) sin(x)+2*x
11. If the characteristic equation has repeated root (*m*=1, *r*=3), then the bases are				
	(A) e^x, e^x, e^x	(B) xe^x, x^2e^x, x^3e^x	(C) e^x, xe^x, x^2e^x	(D) $e^{-x}, xe^{-x}, x^2e^{-x}$

12. **Consider the D.E.** $y'''' - 4y''' + 4y'' = 0$. **Find root of its characteristic equation**

(A) **0, 0, 4, 4** (B) **0, 0, -2, -2** (C) **0, 0, 2, 2** (D) **0, 2**

13. **the D.E** $y'' + ay' + by =$ **cannot be solved using undetermined coefficients method if**

(A) **1** (B) $(1+e^{2x})/e^{x}$ (C) $e^{x}/(1+e^{2x})$ (D) **sinx+cosx**

14. **Find** y_p in the D.E. $y''' + 2y'' = 2$

(A) **2** (B) $2x^2$ (C) x^2 (D) **0, 0, -2**

15. **Find a solution of** $y''' - y'' + y' - y = 0$

(A) e^{-jx} (B) e^{2jx} (C) e^{jx} (D) $e^{jx/2}$

16. **Find** (w_1 - c_1) **or** (w_2 - c_2) **in the solution of** $y'' + y = \sin^2 x$ **by variation of parameters method.**

(A) $(\cos^3 x)/3$ (B) $-(\cos^3 x)/3$ (C) $(\sin^3 x)/3$ (D) $(\cos^3 x)/3 - \cos x$

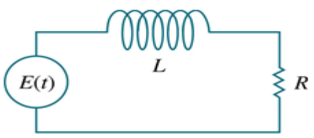
17. **Find number of dependent variables in the system:** $y' = y + z$, $z' = y + z + x$.

(A) **0** (B) **1** (C) **2** (D) **3**

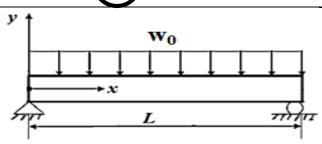
18. **Find** z **in the system:** $y' = z$, $z' = y + x$.

(A) $\alpha e^{x} + \beta e^{-x} - x$ (B) $\alpha e^{x} + \beta e^{-x} + 1$ (C) $\alpha e^{x} + \beta e^{-x} - 1$ (D) $\alpha e^{x} + \beta e^{-x} + x$

19. **The D.E. governs the shown circuit is ….**



(A) **Non-linear** (B) **homogeneous** (C) **Linear** (D) **separable**



20. **Find the D.E. governs the deflection of shown beam.**

(A) $EI\frac{d^4y}{dx^4} + w(x) = 0$ (B) $EI\frac{d^2y}{dx^2} + w(x) = 0$ (C) $EI\frac{d^4y}{dx^4} + w_0 = 0$ (D) $\frac{d^4y}{dx^4} + w(x) = 0$

Fayoum University **1st Civil Eng.** **Differential Equations**
Faculty of Engineering **Makeup -Term exam** **May, 13, 2018**
Examiner: Assoc. Prof. Karem Mahmoud **Time: 35 Min.**

Choose the correct answer as this Figure ● ..

2. **Find the degree and order of D.E:** $\sin x + y^3 + (y')^2 = 0$.

(A) 2, 1 (B) 2, 1 (C) 3, 1 (D) 3, 2

21. **Find the independent variable in the code >> y=dsolve('Dy=y^3*exp(-2*y), 'x')**

(A) y (B) x (C) t (D) D

22. **Solve the D.E:** $y' = \sin^2(x - y + 1), y(0) = -1$

(A) $x - 1 - \tan^{-1}(x)$ (B) $x - \tan^{-1}(x)$ (C) $x - \tan^{-1}(x + c)$ (D) $x - \tan(x)$

23. $(2x + \tan x)\, y' = -(y^2 + y / \cos y)$ **is ..... D.E:**

(A) linear (B) Bernoulli (C) exact (D) separable

24. **Solve the D.E:** $xy' + y = y^2 x^2$

(A) $1/(-x^2 - cx)$ (B) $1/(x^2 + cx)$ (C) $(1+c)/x^2$ (D) $1/(x^2 - cx)$

25. **Find the resistance force in the mechanical system:**

$mg + kv^2 - \lambda v = m\, dv/dt$

(A) $kv^2 - \lambda v$ (B) mg (C) $-mg - kv^2$ (D) λv

26. **The problem:** $y''' + 2xy'' + y' - y = x, y(0) = 1, y'(0) = -1, y''(1) = 0.$ **is .....**

(A) non-linear (B) IVP (C) BVP (D) particular

27. **Find the linearly dependent functions**

(A) e^{-x}, e^x (B) x, e^x (C) exp(x), exp(2+x) (D) sinx, sin(2x)

28. **Solve the D.E:** $4y'' - 12y' + 5y = 0,\ y(0) = 0, y'(0) = 1.$

(A) $e^{x/2}(c - 2ce^{2x})$ (B) $e^{x/2}(1 - e^{2x})$ (C) $c e^{x/2}(1 + e^{2x})$ (D) $c e^{x/2}(1 - e^{2x})$

29. **Find output of the code >> dsolve('D2y+y=2*t','y(0)=0','Dy(0)=1','t')**

(A) -sin(t)+2*t (B) sin(t)+2*t (C) 2*sin(t)+t (D) sin(x)+2*x

30. **If the characteristic equation has repeated root (*m*=1, *r*=3), then the bases are**

A	$e^x,\ xe^x,\ x^2e^x$	B	$e^x, 2e^x, 3e^x$	C	xe^x, x^2e^x, x^3e^x	D	$e^{-x}, xe^{-x}, x^2e^{-x}$

31. **Consider the D.E. $y'''' - 6y''' + 9y'' = 0$. Find root of its characteristic equation**

A	**0, 0, 3, 3**	B	**0, 0, 6, 6**	C	**0, 0, -3, -3**	D	**3, 3**

32. **The D.E $y'' + ay' + by = F$ cannot be solved using undetermined coefficients method if F=…..**

A	**Sinhx*cosx**	B	**1**	C	$(1+e^{2x})/e^x$	D	**sinx+cosx**

33. **Find y_p** in the D.E. $y''' - y'' = 2$

A	$-x^2$	B	x^2	C	$2x^2$	D	**0, 0, 2**

34. **Find a solution of $y''' - y'' + y' - y = 0$**

A	e^{-jx}	B	e^{2jx}	C	e^{jx}	D	$e^{jx/2}$

35. **Find (w_1 - c_1) or (w_2 - c_2) in the solution of $y'' + y = \sin^2 x$ by variation of parameters method.**

A	$(\cos^3 x)/3$	B	$-(\cos^3 x)/3$	C	$(\sin^3 x)/3$	D	$(\cos^3 x)/3 - \cos x$

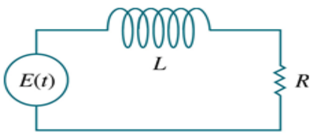
36. **Find number of independent variables in the system: $y' = y + z$, $z' = y + z + x$.**

A	**2**	B	**1**	C	**0**	D	**3**

37. **Find z in the system: $y' = z$, $z' = y + x$.**

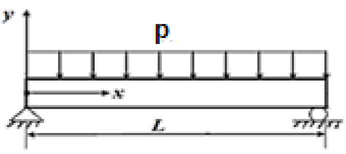
A	$\alpha e^x + \beta e^{-x} + 1$	B	$\alpha e^x + \beta e^{-x} - 1$	C	$\alpha e^x + \beta e^{-x} - x$	D	$\alpha e^x + \beta e^{-x} + x$

38. **The D.E. governs the shown circuit is ….**



A	**exact**	B	**Non-homogeneous**	C	**Non-linear**	D	**separable**

39. **Find the D.E. governs the deflection of shown beam.**



A	$EI\dfrac{d^2y}{dx^2} + p(x) = 0$	B	$EI\dfrac{d^4y}{dx^4} + p = 0$	C	$EI\dfrac{d^4y}{dx^4} + w(x) = 0$	D	$\dfrac{d^4y}{dx^4} + w(x) = 0$

Fayoum University — **1st Civil Eng.** — **Differential Equations**

Faculty of Engineering — **Mid -Term exam** — **March, 31, 2019**

Examiner: Assoc. Prof. Karem Mahmoud — **Time: 45 Min.**

Choose the correct answer as this Figure ● .

1. **Find the degree and order of D.E:** $\sin x + y^2 + y''' = 3$.
   - (A) 3, 1
   - (B) 1, 1
   - (C) 2, 1
   - (D) 1, 3

2. **The D.E:** $y\ y'' + y''' = 3x$ is ……
   - (A) third-order
   - (B) Linear
   - (C) Non-linear
   - (D) homogenous

3. **Solve the D.E:** $y' + 1 = 1/(x+y)$.
   - (A) $\sqrt{x+c}$
   - (B) $\pm\sqrt{2x+c} - x$
   - (C) $\sqrt{x-c}$
   - (D) $\pm\sqrt{2c-2x}$

4. **The D.E:** $(2xy + \tan x)\, y' = -(y^2 + y/\cos^2 x)$ is .....
   - (A) exact
   - (B) Bernoulli
   - (C) linear
   - (D) separable

5. **The D.E:** $xy' + y = y^2 x^2$ is .....
   - (A) linear
   - (B) Bernoulli
   - (C) exact
   - (D) separable

6. **Solve the D.E:** $y' = y/x + x/y$, $y(1) = 0$.
   - (A) $y^2 = c\, x^2 \ln x^2$
   - (B) $y = c\, x \ln x^2$
   - (C) $y^2 = x^2 \ln x^2$
   - (D) $y = 3x \ln x^2$

7. **The problem:** $y''' + 2xy'' + y' - y = x$, $y(0) = 1$, $y'(0) = -1$, $y''(1) = 0$. is .....
   - (A) non-linear
   - (B) IVP
   - (C) particular
   - (D) BVP

8. **Find the linearly dependent bases.**
   - (A) e^{-x}, e^x
   - (B) x, e^x
   - (C) sinx, sin(2x)
   - (D) lnx, $\ln(x^2)$

9. **Solve the D.E:** $y'' + y = 0$, $y(0) = 1, y'(0) = 0$.
   - (A) e^x
   - (B) sinx
   - (C) cosx
   - (D) xe^{-x}

10. **The D.E** $y''' + 2xy'' + y' - y = x$ **has ….coefficients.**
    - (A) constant
    - (B) variable
    - (C) homogenuos
    - (D) degree

11. **If the characteristic equation has repeated root (*m*=1, *r*=3), then the bases are:**
    - (A) e^x, xe^x, x^2e^x
    - (B) e^x, e^x, e^x
    - (C) xe^x, x^2e^x, x^3e^x
    - (D) $e^{-x}, xe^{-x}, x^2e^{-x}$

12. **Consider the D.E.** $y^{(4)} - 4y^{(3)} + 13y^{(2)} - 36y^{(1)} + 36y = 0$. **Find roots of its characteristic equation.**

(A) 3j, 2	(B) 3j, -3j, 2, 2	(C) 3j, -3j, 2	(D) 2j, -2j, 3, -3

13. **The D.E $y''+ay'+by=F$ cannot be solved using undetermined coefficients method if F=…..**

(A) 1	(B) $\ln 2x/\ln x$	(C) $1/(1+e^{2x})$	(D) sinx+cosx

14. **Find $F(x)$ in the D.E. $y'''+2y''+x^2=1$.**

(A) 1	(B) y'''	(C) x^2	(D) $1-x^2$

15. **Find a solution of $y'''-y''+y'-y=0$.**

(A) e^{-2jx}	(B) e^{2jx}	(C) e^{jx}	(D) e^{2x}

16. **Find (w₁ - c₁) or (w₂ - c₂) in the solution of $y''+y=\sin^2 x$ by variation of parameters method.**

(A) $(\cos^3 x)/3$	(B) $-(\cos^3 x)/3$	(C) $(\sin^3 x)/3$	(D) $(\cos^3 x)/3-\cos x$

17. **Find the dependent variable in the D.E.: $\dfrac{dz}{dx}=z+2x$.**

(A) y	(B) x	(C) z	(D) x, z

18. **Find y_p in the system:, $y''=y+x$.**

(A) $-x$	(B) x	(C) $-2x$	(D) $-x/2$

19. **The characteristic equation $m^5-2m^4+m^3=0$ has …..roots.**

(A) 5	(B) 4	(C) 3	(D) 2

20. **Find the non-homogenous D.E.**

(A) $\dfrac{d^2y}{dx^2}+\sin x=0$	(B) $\dfrac{d^4y}{dx^4}+A\dfrac{d^2y}{dx^2}=0$	(C) $\dfrac{d^4y}{dx^4}+Ay=0$	(D) $\dfrac{d^4y}{dx^4}+xy=0$

Fayoum University — **1st Civil Eng.** — **Differential Equations**
Faculty of Engineering — **Make-up exam** — **May., 5, 2019**
Examiner: Assoc. Prof. Karem Mahmoud — **Time: 40 Min.**

Choose the correct answer as this Figure ●

1. **Find the degree and order of D.E:** $\sin x + y^2 + y' = 3$				
	(A) **4, 3**	(B) **3, 2**	(C) **1, 1**	(D) **2, 1**
2. **Find roots of its characteristic equation. In D.E.** $y^{(4)} - 4y^{(3)} + 13y^{(2)} - 36y^{(1)} + 36y = 0$.				
	(A) **3j, 2**	(B) **3j, -3j, 2**	(C) **3j, -3j, 2, 2**	(D) **2j, -2j, 3, -3**
3. **Solve the D.E:** $y' = \sin^2(x - y + 1), y(0) = -1$,				
	(A) $x - 1 - \tan^{-1}(x)$	(B) $x - \tan^{-1}(x + c)$	(C) $x - \tan^{-1}(x)$	(D) $x - \tan(x)$
4. $(2xy + \tan x)\, y' = -(y^2 + y/\cos^2 x)$ **is ..... D.E:**				
	(A) **linear**	(B) **Bernoulli**	(C) **separable**	(D) **exact**
5. $xy' + y = y^2x^2$				
	(A) **1/(-x² -cx)**	(B) **1/(x² +cx)**	(C) **(1+c)/x²**	(D) **1/(x² -cx)**
6. **Solve the D.E:** $y' + 1 = 1/(x + y)$.				
	(A) $\sqrt{x + c}$	(B) $\sqrt{x - c}$	(C) $\pm\sqrt{2c - 2x}$	(D) $\pm\sqrt{2x + c} - x$
7. **The problem:** $y''' + 2xy'' + y' - y = x, y(0) = 1, y'(0) = -1, y''(0) = 0.$ **is .....**				
	(A) **non-linear**	(B) **BVP**	(C) **IVP**	(D) **particular**
8. **Find the linearly dependent functions**				
	(A) e^{-x}, e^{x}	(B) x, e^{x}	(C) **x, 2x**	(D) **sinx, sin(2x)**
9. **Solve the D.E:** $4y'' - 12y' + 5y = 0, y(0) = 0, y'(0) = 1.$				
	(A) $e^{x/2}(c - 2ce^{2x})$	(B) $e^{x/2}(1 - e^{2x})$	(C) $ce^{x/2}(1 - e^{2x})$	(D) $ce^{x/2}(1 + e^{2x})$
10. **Find** y_p **in the system:,** $y'' = y + x$.				
	(A) $-x$	(B) **2*sin(t)+t**	(C) **-sin(t)+2*t**	(D) **sin(x)+2*x**
11. **If the characteristic equation has repeated root (*m*=1, *r*=3), then the bases are**				
	(A) e^{x}, xe^{x}, x^2e^{x}	(B) $xe^{x}, x^2e^{x}, x^3e^{x}$	(C) e^{x}, e^{x}, e^{x}	(D) $e^{-x}, xe^{-x}, x^2e^{-x}$

12. Consider the D.E. $y'''' - 4y''' + 4y'' = 0$. Find root of its characteristic equation			
(A) 0, 0, 2, 2	(B) 0, 0, -2, -2	(C) 0, 0, 4, 4	(D) 0, 2
13. $y'' + ay' + by = F$ is solved by undetermined coefficients method if F=…			
(A) $e^x/(1+e^{2x})$	(B) $(1+e^{2x})/(2+e^x)$	(C) Sinx*cosx	(D) Sinx/cosx
14. Find y_p in the D.E. $y''' + 2y'' = 2$			
(A) 2	(B) $2x^2$	(C) x^2	(D) 0, 0, -2
15. Find a solution of $y''' - y'' + y' - y = 0$			
(A) e^{-jx}	(B) e^{2jx}	(C) e^{jx}	(D) $e^{jx/2}$
16. Find (w_1 - c_1) or (w_2 - c_2) in the solution of $y'' + y = \sin^2 x$ by variation of parameters method.			
(A) $(\cos^3 x)/3$	(B) $-(\cos^3 x)/3$	(C) $(\sin^3 x)/3$	(D) $(\cos^3 x)/3 - \cos x$
17. Find number of dependent variables in the system: $y' = y + z$, $z' = y + z + x$.			
(A) 0	(B) 1	(C) 2	(D) 3
18. Find z in the system: $y' = z$, $z' = y + x$.			
(A) $\alpha e^x + \beta e^{-x} - x$	(B) $\alpha e^x + \beta e^{-x} + 1$	(C) $\alpha e^x + \beta e^{-x} - 1$	(D) $\alpha e^x + \beta e^{-x} + x$
19. The characteristic equation $m^5 - 2m^4 + m^3 = 0$ has …..roots.			
(A) 5	(B) 3	(C) Linear	(D) no
20. Find the non-homogenous D.E.			
(A) $\frac{d^2y}{dx^2} + \sin x = 0$	(B) $EI\frac{d^2y}{dx^2} + w(x) = 0$	(C) $EI\frac{d^4y}{dx^4} + w_0 = 0$	(D) $\frac{d^4y}{dx^4} + w(x) = 0$

Final-Term Exams

Fayoum University **Final Term Exam.** **Differential Equations** **1st Year Civil Eng. Dept.**
Faculty of Engineering **June, 2, 2018** **Max. Points: 60** **Time: 3 Hrs.**
Examiner: Assoc. Prof. Karem Mahmoud **Ewis**

مسموح ب ٨ صفحات قوانين - يجيب الطالب في نفس أوراق الأسئلة و في ظهورها الفارغة
درجات السؤال الأول موزعة بانتظام على جزئياته و تظليل الاختيار يكون كما هو موضح في رأس السؤال

Exam instructions

1- Only one sheet answer is allowed for every student.
2- It is not allowed to borrow the tools (pen, pencils, drawing tools, calculator …etc.).
3- It is not allowed to use the cell phone or any of its application during the time of exam.

Question No 1: Choose the correct answer as this Figure ● (40 M)

1. **Find a_o in the Fourier series of the periodic function $f(x)=\pi^2-x^2$, where, $-\pi<x<\pi$.**

   (A) 6.58 (B) 13.16 (C) 0 (D) 4.39

2. **Find $F_s(n)$ of $f(x)=\pi$, where, $p=\pi$ and n=6.**

   (A) $\pi\left(1-(-1)^n\right)/n$ (B) 0 (C) 1.05 (D) $2\pi/(2m-1)$

3. **Solve the D.E: $y'=\sin^2(x-y+1), y(0)=1$.**

   (A) $x-1-\tan^{-1}(x)$ (B) $x-\tan^{-1}(x)+1$ (C) $x-\tan^{-1}(x+1)$ (D) $x-\tan(x)+1$

4. **Find inverse Laplace transform of $s/[(s-2)(s-1)]$**

   (A) $(e^t-e^{2t})/2$ (B) e^t-e^{2t} (C) $e^{2t}+e^t$ (D) $2e^{2t}-e^t$

5. **Solve the D.E: $xy'+y=y^2x^2$**

   (A) $1/(-x^2-cx)$ (B) $1/(x^2+cx)$ (C) $(1+c)/x^2$ (D) $1/(x^2-cx)$

6. **Find Laplace transform of $u_1(t)\sin(t-1)$, where, s=2.**

   (A) $\dfrac{e^{-s}}{s^2+1}$ (B) 0.027 (C) 0.135 (D) 0.068

7. **The problem: $y'''+2xy''+y'-y=x$, $y(0)=1$, $y'(0)=-1, y''(1)=0$. is .....**

   (A) non-linear (B) IVP (C) BVP (D) particular

8. **Find Laplace transform of t^{100} .**

   (A) $101!/s^{101}$ (B) $100!/s^{100}$ (C) $100!/s^{101}$ (D) $100/s^{101}$

9. **Solve the D.E: $4y''-12y'+5y=0$, $y(0)=0, y'(0)=1$.**

   (A) $e^{x/2}(c-2ce^{2x})$ (B) $e^{x/2}(1-e^{2x})$ (C) $ce^{x/2}(1+e^{2x})$ (D) $ce^{x/2}(1-e^{2x})$

10. **Find output of the code** >> dsolve('D2y+y=2*t','y(0)=0','Dy(0)=1','t')

(A) sin(t)+2*t (B) -sin(t)+2*t (C) 2*sin(t)+t (D) sin(x)+2*x

11. **If the characteristic equation has repeated root (*m*=1, *r*=3), then the bases are**

(A) $e^x,\ xe^x,\ x^2e^x$ (B) $e^x,\ 2e^x,\ 3e^x$ (C) xe^x, x^2e^x, x^3e^x (D) $e^{-x}, xe^{-x}, x^2e^{-x}$

12. **Consider the D.E.** $y'''' - 6y''' + 9y'' = 0$. **Find root of its characteristic equation**

(A) 0, 0, 3, 3 (B) 0, 0, 6, 6 (C) 0, 0, -3, -3 (D) 3, 3

13. **The D.E** $y'' + ay' + by = F$ **cannot be solved using undetermined coefficients method if F=…..**

(A) sinhx*cosx (B) 1 (C) $(1+e^{2x})/e^x$ (D) sinx+cosx

14. **Find** y_p in the D.E. $y''' - y'' = 2$

(A) $-x^2$ (B) x^2 (C) $2x^2$ (D) 0, 0, 2

15. **Find a solution of** $y''' - y'' + y' - y = 0$

(A) e^{-jx^2} (B) e^{2jx} (C) e^{jx} (D) $e^{jx/2}$

16. **Find (w1 - c1) or (w2 - c2) in the solution of** $y'' + y = \sin^2 x$ **by variation of parameters method.**

(A) $(\cos^3 x)/3$ (B) $-(\cos^3 x)/3$ (C) $(\sin^3 x)/3$ (D) $\left(\frac{\cos^3 x}{3}\right) - \cos x$

17. **Find number of independent variables in the system:** $y' = y + z,\ z' = y + z + x$.

(A) 2 (B) 1 (C) 0 (D) 3

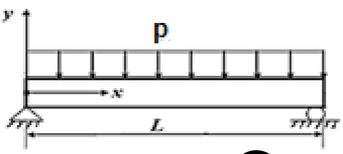
18. **Find** z **in the system:** $y' = z,\ z' = y + x$.

(A) $\alpha e^x + \beta e^{-x} + 1$ (B) $\alpha e^x + \beta e^{-x} - 1$ (C) $\alpha e^x + \beta e^{-x} - x$ (D) $\alpha e^x + \beta e^{-x} + x$

19. **The series:** $\sum_{k=1}^{\infty} \frac{x^k}{k * 2^{2k}}$ **convergences around origin in the interval ……**

(A) [-4, 4] (B) (-4, 4) (C) (-2, 2) (D) [-2, 2]

20. **Find the D.E. governs the deflection of shown beam.**



(A) $EI\frac{d^2y}{dx^2} + p(x) = 0$ (B) $EI\frac{d^4y}{dx^4} + p = 0$ (C) $EI\frac{d^4y}{dx^4} + w(x) = 0$ (D) $\frac{d^4y}{dx^4} + w(x) = 0$

Question No 2 (10 Marks)

Find a power series solution of the D.E. $y'' + (5/2)\,y' + y = 2x$ **up to** x^4**.**

Solution

Consider the solution: $y(x) = \sum_{k=0}^{\infty} c_k\, x^k$, then,

$y'(x) = \sum_{k=1}^{\infty} k\, c_k\, x^{k-1}$ and $y''(x) = \sum_{k=2}^{\infty} k(k-1)\, c_k\, x^{k-2}$.

We can substitute from table (1) the present D.E. thus, we find that

$\mathbf{y'' + 2.5y' + y = 2x} \;\rightarrow$

$$\sum_{k=2}^{\infty} k(k-1)\, c_k\, x^{k-2} + \sum_{\mathbf{k=1}}^{\infty} \mathbf{2.5k\, c_k\, x^{k-1}} + \sum_{k=0}^{\infty} c_k\, x^k = 2x$$

$$\sum_{i=2}^{\infty} i(i-1)\, c_i\, x^{i-2} + \sum_{\mathbf{j=1}}^{\infty} \mathbf{2.5j\, c_j\, x^{j-1}} + \sum_{k=0}^{\infty} c_k\, x^k = 2x$$

To find coefficients of x^k in R.H.S, we may use the following substitution.

$i\text{-}2 = k \quad j\text{-}1 = k$.

$$\sum_{k=0}^{\infty} (k+2)(k+1)c_{k+2}\, x^k + \sum_{\mathbf{k=0}}^{\infty} \mathbf{2.5(k+1)c_{k+1}\, x^k} + \sum_{k=0}^{\infty} c_k\, x^k = 2x$$

$$\sum_{\mathbf{k=0}}^{\infty} \left\{\mathbf{(k+2)(k+1)c_{k+2} + 2.5(k+1)c_{k+1} + c_k}\right\}\mathbf{x^k} = \mathbf{2x}$$

This equation shows that coefficients of x^k **in L.H.S equal to zero except coefficients of** x **equal to 2. Thus a recurrence relation between coefficients are written as**

$$\mathbf{c_{k+2}} = \begin{cases} -\dfrac{\mathbf{2.5(k+1)c_{k+1} + c_k}}{\mathbf{(k+2)(k+1)}}, \mathbf{k \neq 1} \\[2ex] \dfrac{\mathbf{2 - 2.5(k+1)c_{k+1} - c_k}}{\mathbf{(k+2)(k+1)}}, \mathbf{k = 1} \end{cases}$$

We can obtain the following coefficients by successive substitutions in the above recurrence relation.

Table coefficients in example

k	**0**	**1**	**2**
$\mathbf{c_{k+2}} =$	$\mathbf{c}_2 =$	$\mathbf{c}_3 =$	$\mathbf{c}_4 =$
Expression	$-\dfrac{\mathbf{c_0}}{\mathbf{2}} - \dfrac{\mathbf{5c_1}}{\mathbf{4}}$	$\dfrac{\mathbf{5c_0}}{\mathbf{12}} + \dfrac{\mathbf{7c_1}}{\mathbf{8}} + \dfrac{\mathbf{1}}{\mathbf{3}}$	$-\dfrac{\mathbf{7c_0}}{\mathbf{32}} - \dfrac{\mathbf{85c_1}}{\mathbf{192}} - \dfrac{\mathbf{1}}{\mathbf{24}}$

The solution may be obtained by substituting in the power series expansion of $\sum_{k=0}^{\infty} c_k\, x^k$ **as**

$y(x) = (\mathbf{c_0} + \mathbf{c_1\, x} + \mathbf{c_2\, x^2} + \mathbf{c_3\, x^3} + \mathbf{c_4\, x^4} + \mathbf{c}_5\, \mathbf{x}^5 + \mathbf{c}_6\, \mathbf{x}^6 + \ldots.$

$$y(x)=c_0\left(1-\frac{x^2}{2}+\frac{5x^3}{12}-\frac{7x^4}{32}+.....\right)+c_1\left(x-\frac{5x^2}{4}+\frac{7x^3}{8}-\frac{85x^4}{192}+.....\right)+\frac{x^3}{3}-\frac{5x^4}{24}+.....$$

$$=c_0(1-0.5x^2+0.117x^3-0.219x^4+.....)+c_1(x-1.25x^2+0.875x^3-0.443x^4+.....)$$
$$+0.333x^3-0.208x^4+.....$$

Question No 3 (10 Marks)

a) Use the Fourier transform to solve the following problem.

$y''-y=f(x)$, where, $f(x)=\begin{cases}1 & 0<x<0.5\\ 0 & 0.5\le x<1\end{cases}$, $y'(0)=-1$, $y'(1)=0$.

b) Use the Laplace transform to solve the following problem.

$\ddot{y}+5\dot{y}+4y=0$, $y(0)=1$, $\dot{y}(0)=1$.

Solution

a) Taking the Fourier cosine transform of the given D.E, we find that

$$F_c\left(\frac{d^2y}{dx^2}-y\right)=F_c(f(x))$$

$$-\left(\frac{n\pi}{p}\right)^2 Y_c(n)+(-1)^n y'(p)-y'(0)-Y_c(n)=F_c(f(x))$$

$$\left((n\pi)^2-1\right)Y_c(n)+1=\int_0^{0.5}\cos(2n\pi x)\,dx+0=\frac{1}{n\pi}\sin(n\pi\ x)_0^{0.5}=\frac{1}{n\pi}\sin\left(\frac{n\ \pi}{2}\right)$$

$$\left(n^2\pi^2-1\right)Y_c(n)+1=\begin{cases}0.5, & (n=0)\\ 1 & (n=1,5,9,,\ldots)\\ -1 & (n=3,7,11,\ldots)\\ 0 & (n=2,4,6,\ldots)\end{cases},$$

$$Y_c(n)=\begin{cases}\dfrac{-0.5}{\left(n^2\pi^2-1\right)}, & (n=0)\\ 0 & (n=1,5,9,,\ldots)\\ \dfrac{-2}{\left(n^2\pi^2-1\right)} & (n=3,7,11,\ldots)\\ \dfrac{-1}{\left(n^2\pi^2-1\right)} & (n=2,4,6,\ldots)\end{cases}$$

Taking the inverse Fourier cosine transform of last result, we find that

$$y(x)=\frac{F_c(0)}{p}+\frac{2}{p}\sum_{n=1}^{\infty}F_c(n)\cos\frac{n\pi x}{p}\longrightarrow$$

$$y(x)=\frac{-0.5}{\left(n^2\pi^2-1\right)}+2\sum_{n=1}^{\infty}F_c(n)\cos(n\pi x)$$

b) $\ddot{y}+5\dot{y}+4y=0,\ y(0)=1,\ \dot{y}(0)=1.$

$\ddot{y}-\dot{y}-4y=0,\ y(0)=2,\ \dot{y}(0)=3$

Taking Laplace transform (L.T) of the D.E,

$$\mathcal{L}\left(\ddot{y}+5\dot{y}+4y\right)=0\rightarrow s^2Y(s)-s\,y(0)-\dot{y}(0)+5sY(s)-5y(0)+4Y(s)=0$$

$$(s^2+5s+4)Y(s)=2s+13\rightarrow Y(s)=\frac{2s+13}{s^2+5s+4}\quad \textbf{(quadratic expression)}$$

$$Y(s)=\frac{2s+13}{(s+5/2)^2-25/4+4}=2\frac{s+2.5+4}{(s+5/2)^2-(3/2)^2}=2\frac{s+5/2}{(s+5/2)^2-(3/2)^2}+\frac{16}{3}\frac{3/2}{(s+5/2)^2-(3/2)^2}$$

Taking inverse Laplace transform (I.L.T), we find the final solution as

$$\boxed{y(t)=2e^{-5t/2}\left[\cosh(3t/2)+(8/3)\sinh(3t/2)\right]}$$

Another inverse (using partial fraction)

$$\frac{2s+13}{s^2+5s+4}=\frac{2s+13}{(s+1)(s+4)}=\frac{A}{(s+1)}+\frac{B}{(s+4)}=\frac{11}{3(s+1)}-\frac{5}{3(s+4)}$$

$$\boxed{y(t)=11e^{-t}/3-5e^{-4t}/3}$$

امتحان التخلف

Fayoum University Final Term Exam. Differential Equations 1st Year Civil Eng. Dept.
Faculty of Engineering May, 7, 2019 Max. Points: 60 Time: 3 Hrs.
Examiner: Assoc. Prof. Karem Mahmoud Ewis

مسموح ب ٨ صفحات قوانين - يجيب الطالب في نفس أوراق الأسئلة و في ظهورها الفارغة   **درجات السؤال الأول موزعة بانتظام على جزئياته و تظليل الاختيار يكون كما هو موضح في رأس السؤال**

Exam instructions

4- Only one sheet answer is allowed for every student.
5- It is not allowed to borrow the tools (pen, pencils, drawing tools, calculator …etc.).
6- It is not allowed to use the cell phone or any of its application during the time of exam.

Question No 1: Choose the correct answer as this Figure ● (60 M)

1. Find a_o in the Fourier series of the periodic function $f(x) = x^3 \sin x$, where, $-\pi < x < \pi$.				
	A 6.58	B 0	C 0	D 4.39
2. Find $F_s(n)$ of $f(x) = \pi$, where, $p = \pi$ and n=2.				
	A $\pi\left(1-(-1)^n\right)/n$	B π	C 1.05	D $2\pi/(2m\text{-}1)$
3. Solve the D.E: $y' = y^3 e^{-2x}$.				
	A $1/\sqrt{e^{-2x}-2c}$	B $\pm 1/\sqrt{e^{-2x}-2c}$	C $\pm 1/\sqrt{e^{2x}-2c}$	D $\pm\sqrt{e^{-2x}-2c}$
4. Find inverse Laplace transform of $s/[(s-2)(s-1)]$				
	A $(e^t - e^{2t})/2$	B $e^t - e^{2t}$	C $e^{2t} + e^t$	D $2e^{2t} - e^t$
5. Solve the D.E: $x^2 y y' + y^2 x = x^3$				
	A $\pm x\sqrt{\dfrac{1-cx^{-4}}{2}}$	B $x\sqrt{\dfrac{1-cx^{-4}}{2}}$	C $\pm\sqrt{\dfrac{1-cx^{-4}}{2}}$	D $\pm x\sqrt{\dfrac{1+cx^{-4}}{2}}$
6. Find Laplace transform of $u_1(t)\sin(t-1)$, where, s=2.				
	A $\dfrac{e^{-s}}{s^2+1}$	B 0.027	C 0.135	D 0.068
7. The problem: $y''' + 5xy' - y = x, y(0)=1,\ y'(0)=5, y''(1)=0.$ is				
	A non-linear	B IVP	C BVP	D particular
8. Find Laplace transform of t^{10}.				
	A $11!/s^{11}$	B $10!/s^{10}$	C $10!/s^{11}$	D $10/s^{11}$
9. Solve the D.E: $y'' - 8y' + 16y = 0$.				
	A $(c_1 + c_2 x)e^{-2x}$	B $(c_1 + c_2 x)e^{-4x}$	C $(c_1 + c_2 x)e^{2x}$	D $(c_1 + c_2 x)e^{4x}$

10. **Find output of the code** `>> dsolve('D2y+2*y=2*t','y(0)=0','Dy(0)=1','t')`

Ⓐ **sin(t)+2*t** Ⓑ **t** Ⓒ **2*sin(t)+t** Ⓓ **sin(x)+2*x**

11. **If the characteristic equation has repeated root (*m*=1, *r*=2), then the bases are**

Ⓐ $e^x,\ xe^x$ Ⓑ $e^x,\ 2e^x,$ Ⓒ $xe^x,\ x^2e^x$ Ⓓ $e^{-x},\ xe^{-x}$

12. **Consider the D.E.** $y'''' - 12y''' + 36y'' = 0$ **. Find root of its characteristic equation**

Ⓐ **0, 0, 6, 6** Ⓑ **0, 0, 3, 3** Ⓒ **0, 0, -3, -3** Ⓓ **3, 3**

13. **The D.E** $y'' + ay' + by = F$ **cannot be solved using undetermined coefficients method if F=.....**

Ⓐ $e^x/(1+e^{2x})$ Ⓑ x Ⓒ e^{2x} Ⓓ **sinx+cosx**

14. **Find** y_p in the D.E. $y''' + y'' = 10$.

Ⓐ $5x^2$ Ⓑ $-5x^2$ Ⓒ $10x^2$ Ⓓ **0, 0, 1**

15. **Find a solution of** $y''' + y' = 0$ **.**

Ⓐ e^x Ⓑ e^{2jx} Ⓒ e^{jx} Ⓓ $e^{jx/2}$

16. **Find** $(w_1 - c_1)$ **or** $(w_2 - c_2)$ **in the solution of** $y'' + y = \sin^2 x$ **by variation of parameters method.**

Ⓐ $(\cos^3 x)/3$ Ⓑ $-(\cos^3 x)/3$ Ⓒ $(\sin^3 x)/3$ Ⓓ $\left(\frac{\cos^3 x}{3}\right) - \cos x$

17. **Find number of dependent variables in the system:** $xy' = y - 2z,\ z' = y' + z + x$.

Ⓐ **1** Ⓑ **2** Ⓒ **0** Ⓓ **3**

18. $F_s\left(\frac{dy}{dx}\right) = ...$

Ⓐ $\frac{n\pi}{p} Y_c(n)$ Ⓑ $-\frac{n\pi}{p} Y_c(n)$ Ⓒ $-\frac{n\pi}{p} Y_s(n)$ Ⓓ $\frac{n\pi}{p} Y_s(n)$

19. **The series:** $\sum_{k=1}^{\infty} \frac{x^k}{k * 3^{2k}}$ **convergences around origin in the interval ……**

Ⓐ **[-9, 9]** Ⓑ **(-9, 9)** Ⓒ **(-3, 3)** Ⓓ **[-3, 3]**

20. $L(\dot{y}(t)) = ...$

Ⓐ $sY(s)$ Ⓑ $sY(s) - y(0)$ Ⓒ $Y(s)$ Ⓓ $sY(s) - y'(0)$

Question No 2 (20 Marks)

Find a power series solution of the D.E. $y'' + x\,y' + y = 1$ up to x^5.

Solution

Consider the solution: $y(x) = \sum_{k=0}^{\infty} c_k\, x^k$, then,

$y'(x) = \sum_{k=1}^{\infty} k\, c_k\, x^{k-1}$ and $y''(x) = \sum_{k=2}^{\infty} k(k-1)\, c_k\, x^{k-2}$.

We can substitute from in D.E. thus, we find that

$\mathbf{y'' + x\,y' + y = 1} \rightarrow$

$$\sum_{k=2}^{\infty} k(k-1)\, c_k\, x^{k-2} + \sum_{\mathbf{k=1}}^{\infty} \mathbf{k\, c_k\, x^k} + \sum_{k=0}^{\infty} c_k\, x^k = 2x$$

To find coefficients of x^k in R.H.S, we may use the following replacement.

$$\sum_{k=0}^{\infty} (k+2)(k+1)c_{k+2}\, x^k + \sum_{\mathbf{k=0}}^{\infty} \mathbf{kc_k\, x^k} + \sum_{k=0}^{\infty} c_k\, x^k = 2x$$

This equation shows that coefficients of x^k in L.H.S equal to zero except coefficients of x^0 equal to 2. Thus a recurrence relation between coefficients are written as

$$\mathbf{c_{k+2}} = \begin{cases} \dfrac{1-(\mathbf{k}+1)\mathbf{c_k}}{(\mathbf{k}+2)(\mathbf{k}+1)}, & \mathbf{k} = 0 \\ \dfrac{-\mathbf{c_k}}{(\mathbf{k}+2)}, & \mathbf{k} \neq 0 \end{cases}$$

We can obtain the following coefficients by successive substitutions in the above recurrence relation.

Table coefficients in example

k	**0**	**1**	**2**	**3**
$\mathbf{c_{k+2}}$	$\mathbf{c_2} =$	$\mathbf{c_3} =$	$\mathbf{c_4} =$	$\mathbf{c_5} =$
Expression	$\frac{1}{2} - \frac{\mathbf{c_0}}{2}$	$\frac{-\mathbf{c_1}}{3}$	$\frac{\mathbf{c_0}}{8} - \frac{1}{8}$	$\frac{\mathbf{c_1}}{15}$

The solution may be obtained by substituting in the power series expansion of $\sum_{k=0}^{\infty} c_k\, x^k$ **as**

$$y(x) = (\mathbf{c_0} + \mathbf{c_1\, x} + \mathbf{c_2\, x^2} + \mathbf{c_3\, x^3} + \mathbf{c_4\, x^4} + \mathbf{c_5\, x^5} + \ldots.$$

$$\boxed{\begin{aligned} &\mathbf{y = c_0\,(1 - \frac{x^2}{2} + \frac{x^4}{8} + ...) + c_1\,(x - \frac{x^3}{3} - \frac{x^5}{15} + ...) + \frac{x^2}{2} - \frac{x^4}{8} + ...} \\ &\mathbf{= c_0\,(1 - 0.5x^2 + 0.125x^4 + ...) + c_1\,(x - 0.333x^3 - 0.0667x^5 + ...) + 0.5x^2 - 0.125x^4 + ...} \end{aligned}}$$

Question No 3 (20 Marks)

a) Use the finite Fourier transforms to solve the following problem.

$\mathbf{\frac{d^2y}{dx^2} + y = x}$, **with the boundary co**nditions: $\mathbf{y(0) = 1}$ and $\mathbf{y(1) = 0}$

b) Use the Laplace transform to solve the following problem.

$\mathbf{\ddot{y} - \dot{y} - 4y = 0}$, $\mathbf{y(0) = 2}$, $\mathbf{\dot{y}(0) = 3}$.

Solution

a) Taking the Fourier sine transform of the given D.E, we find that

$$F_s\left(\frac{d^2y}{dx^2} + y\right) = F_s(x)$$

$$-(n\pi)^2 Y_s(n) + n\pi\left(y(0) + (-1)^{n+1} y(1)\right) + Y_s(n) = \int_0^1 \underbrace{x\sin(n\pi x)}_{\text{by parts}}\,dx$$

$$\left(1-(n\pi)^2\right)Y_s(n) + n\pi = \frac{(-1)^{n+1}}{n\pi} \to Y_s(n) = \frac{(-1)^n}{n\pi\left(1-(n\pi)^2\right)}$$

Taking the inverse Fourier sine transform of last result, we find that

$$y_s(x) = \frac{2}{p}\sum_{n=1}^{\infty} F_s(n)\sin\frac{n\pi x}{p} = y_s(x) = 2\sum_{n=1}^{\infty} \frac{(-1)^n}{n\pi\left(1-(n\pi)^2\right)}\sin n\pi x$$

$$\boxed{y(x) = \frac{2}{\pi}\sum_{n=1}^{\infty} \frac{(-1)^n}{n\left(1-(n\pi)^2\right)}\sin n\pi x}$$

b) $\ddot{y} - \dot{y} - 4y = 0$, $y(0) = 2$, $\dot{y}(0) = 3$

Taking Laplace transform (L.T) of the D.E,

$$\mathcal{L}(\ddot{y} - \dot{y} - 4y) = 0 \to s^2\mathrm{Y}(s) - s\,y(0) - \dot{y}(0) - s\mathrm{Y}(s) + y(0) - 4\mathrm{Y}(s) = 0$$

$$(s^2 - s - 4)\mathrm{Y}(s) = 2s + 1 \to \mathrm{Y}(s) = \frac{2s+1}{s^2 - s - 4} \quad \text{(quadratic expression)}$$

$$\mathrm{Y}(s) = \frac{2s+1}{(s-1/2)^2 - 1/4 - 4} = 2\frac{s - 1/2 + 1/2}{(s-1/2)^2 - 17/4} = 2\frac{s-1/2}{(s-1/2)^2 - 17/4} + \frac{1}{(s-1/2)^2 - 17/4}$$

Taking inverse Laplace transform (I.L.T), we find the final solution as

$$\mathrm{y(t)} = 2e^{t/2}\left(\cosh(\sqrt{17}t/2) + (2/\sqrt{17})\sinh(\sqrt{17}t/2)\right).$$

Examiner: Ass. Prof Dr. Karem Mahmoud Ewis

<u>Exam instruction</u>

7- **Only one sheet answer is allowed for every student.**

8- **It is not allowed to borrow the tools (pen, pencils, drawing tools, calculator …etc.).**

9- **<u>It is not allowed to use the cell phone or any of its application during the time of exam.</u>**

Question No 1 (24 Marks) Choose the correct answer as this Figure ●

1. **Find the degree and order of D.E:** $\sin x + y^2 + y' = 3$

   (A) 4, 3 (B) 1, 1 (C) 2, 1 (D) 3, 2

2. **Find the independent variable in the code >> y=dsolve('Dy=y^3*exp(-2*y))**

   (A) y (B) t (C) x (D) D

3. **Solve the D.E:** $y' = \sin^2(x-y+1), y(0) = -1$

   (A) $x-1-\tan^{-1}(x)$ (B) $x-\tan^{-1}(x)$ (C) $x-\tan^{-1}(x+c)$ (D) $x-\tan(x)$

4. $(2xy+\tan x)\, y' = -(y^2 + y/\cos^2 x)$ **is ….. D.E:**

   (A) exact (B) Bernoulli (C) separable (D) linear

5. $xy' + y = y^2x^2$

   (A) 1/(x^2 -cx) (B) 1/(x^2 +cx) (C) (1+c)/x^2 (D) 1/(-x^2 -cx)

6.

   (A) kv^2 (B) mg (C) $-mg-kv^2$ (D) -kv^2

7. **The problem:** $y''' + 2xy'' + y' - y = x$, $y(0)=1$, $y'(0)=-1, y''(0)=0.$ **is …..**

   (A) non-linear (B) BVP (C) particular (D) IVP

8. **Find the linearly dependent functions**

   (A) e^{-x}, e^x (B) x, e^x (C) sinx, sin(2x) (D) x, 2x

9. **Solve the D.E:** $4y'' - 12y' + 5y = 0$, $y(0)=0, y'(0)=1.$

   (A) $e^{x/2}(c-2ce^{2x})$ (B) $e^{x/2}(1-e^{2x})$ (C) $ce^{x/2}(1-e^{2x})$ (D) $ce^{x/2}(1+e^{2x})$

10. **Find output of the code >> dsolve('D2y+y=2*t','y(0)=0','Dy(0)=1','t')**

    (A) -sin(t)+2*t (B) sin(t)+2*t (C) 2*sin(t)+t (D) sin(x)+2*x

11. **If the characteristic equation has repeated root (*m*=1, *r*=3), then the bases are**

    (A) xe^x, x^2e^x, x^3e^x (B) e^x, $2e^x$, $3e^x$ (C) xe^x, e^x, x^2e^x, (D) e^{-x}, xe^{-x}, x^2e^{-x}

12. **Consider the D.E.** $y'''' - 4y''' + 4y'' = 0$. **Find root of its characteristic equation**

Ⓐ 0, 0, -2, -2	Ⓑ 0, 0, 4, 4	Ⓒ 0, 0, 2, 2	Ⓓ 0, 2

Question No 2 (10 Marks)

a) Find a power series solution of the D.E. $y'' + 5y' + y = 2x$ **up to** x^4.

b) Find the interval of convergence of the series: $\sum_{k=1}^{\infty} \frac{x^{2k+1}}{k^2\, 2^{2k}}$.

Question No 3 (10 Marks)

a) Find the Fourier series of the periodic function $f(x) = \pi^2 - x^2$ **on the interval:** $-\pi < x < \pi$.

b) Use the Fourier transform to solve the following problem.

$y'' - y = f(x)$, **where,** $f(x) = \begin{cases} 1 & 0 < x < 0.5 \\ 0 & 0.5 \le x < 1 \end{cases}$, $\quad y'(0) = -1$, $\quad y'(1) = 0$.

Question No 4 (10 Marks)

a) Find Laplace transform (L.T) of the following functions:

$f(t) = e^{6t} + \sin(5t) + e^{at}\cosh(bt)$ and $\frac{d^3y}{dt^3}$.

b) Find inverse Laplace transform (I.L.T) of the following functions:

$H(s) = \frac{3}{s} - \frac{5}{s^2+4} - \frac{30}{s^7}$ **and** $F(s) = \left(\frac{1}{s}\right)\left(\frac{1}{s^2-16}\right)$

Question No 5 (6 Marks)

Use the Laplace transform to solve the following problem.

$\ddot{y} + 5\dot{y} + 4y = 0$, $y(0) = 1$, $\dot{y}(0) = 1$.

References

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