	DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE **Supplementary Examination – Summer 2024** **Course: B. Tech. (Common to all Branches)** **Semester : II** **Subject Name & Code: Engineering Mathematics – II (MATH 201_Y17)** **Max Marks: 60** **Date:12.06.2024** **Duration: 3 Hrs.**	
	Instructions to the Students: 1. Attempt **any FIVE** questions of the following. 2. *Use of non-programmable scientific calculators is allowed.* 3. *Assume suitable data wherever necessary and mention it clearly.*	
		Marks
Q. 1	**Solve Any Two of the following.**	**12**
A)	Find all the values of $(i)^{\frac{1}{4}}$	**6**
B)	If tan¿¿ prove that (i) $\tan 2A = \frac{2x}{1-x^2-y^2}$ (ii) $\tan h 2B = \frac{2y}{1+x^2+y^2}$.	**6**
C)	Prove that $\log(1+e^{2i\theta}) = \log(2\cos\theta) + i\theta$.	**6**
Q.2	**Solve Any Two of the following:**	**12**
A)	Solve: $(x^2-y^2)dx = 2xy\,dy$.	**6**
B)	Solve: $\cos^2 x \frac{dy}{dx} + y = \tan x$.	**6**
C)	Two particles fall freely, one in a medium whose resistance is equal to k times the velocity and other in a medium whose resistance is equal to k times the square of the velocity. If V_1 and V_2 are their maximum velocities respectively, show that $V_1 = V_2^2$.	**6**
Q. 3	**Solve any Two of the following:**	**12**
A)	Solve: $(D^2 - 3D + 2)\,y = e^{3x}$.	**6**
B)	Solve: $(D^6 - D^4)\,y = x^2$.	**6**
C)	Solve by the method of variation of parameters $\frac{d^2 y}{dx^2} + y = \operatorname{cosec} x$.	**6**
Q.4	**Solve any Two of the following:**	**12**
A)	Find the Fourier series of $f(x) = x^2$ in the interval $(-\pi, \pi)$, and hence deduce that $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$	**6**
B)	Find a Fourier series to represent $f(x) = x - x^2$ from $x = -\pi$ **to** $x = \pi$.	**6**
C)	Expand the function $f(x) = \pi x - x^2$ in a half – range sine series in the interval $(0, \pi)$.	**6**
Q. 5	**Solve any Two of the following:**	**12**
A)	The necessary and sufficient condition for vector $\vec{F}(t)$ to have constant magnitude is	**6**

	$\vec{F}(t) \cdot \frac{d\vec{F}(t)}{dt} = 0$.	
B)	If the force acting on the particle is at all times perpendicular to the direction of the motion, show that the speed remains constant**.**	**6**
C)	A point moves in a plane so that its tangential and normal components of acceleration are equal and angular velocity of the tangent is constant and equal to ω. Show that the path is equiangular spiral $\omega s = A e^{\omega t} + B$, where A and B are the constant.	**6**
Q. 6	**Solve any Two of the following:**	
A)	Find Curl $\vec{F}$, where $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$	**6**
B)	If $\vec{r}$ is a position vector with $r = \lvert\vec{r}\rvert$, show that $\nabla \times (r^n \vec{r}) = 0$.	**6**
C)	Show that $\iiint_v \frac{dv}{r^2} = \iint_s \frac{\vec{r} \cdot \hat{n}}{r^2} ds$.	**6**
	*** **End** ***	

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular/Supplementary Summer Examination – 2024

Course: B. Tech. **Branch: FE All** **Semester: II**

Subject Code & Name: BTBS201/ Engineering Mathematics-II

Max Marks: 60 **Date:12/06/2024** **Duration: 3 Hr.**

Instructions to the Students:

1. *All the questions are compulsory.*
2. *The level of questions expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks
Q. 1	**Solve any two of the following.**		**12**
A)	If z_1 and z_2 are any two complex numbers such that $\lvert z_1+z_2\rvert=\lvert z_1-z_2\rvert$, show that the difference of their amplitude is $\pi/2$	**Apply (CO1)**	**6**
B)	Find continued product of four values of $\left[\frac{1}{2}+i\frac{\sqrt{3}}{2}\right]^{3/4}$	**Understand (CO1)**	**6**
C)	Show that $\tan\left[i\log\left(\frac{a-ib}{a+ib}\right)\right]=\frac{2ab}{a^2-b^2}$	**Understand (CO1)**	**6**
Q.2	**Solve any two of the following.**		**12**
A)	Solve $(x+y-2)dx+(x-y+4)dy=0$	**Apply (CO2)**	**6**
B)	Solve $\cos^2 x\frac{dy}{dx}+y=\tan x$	**Apply (CO2)**	**6**
C)	A coil is having resistance of 15Ω & inductance L of 10H is connected to 90V supply. Determine the value of current after two sec.	**Apply (CO2)**	**6**
Q. 3	**Solve any two of the following.**		**12**
A)	Solve $(D^2-4D+4)y=xe^{2x}sinx$	**Apply (CO3)**	**6**
B)	Solve by variation of parameters $(D^2+6D+9)y=\frac{e^{-3x}}{x^3}$	**Apply (CO3)**	**6**
C)	Solve $x^2\frac{d^2y}{dx^2}-3x\frac{dy}{dx}+3y=x^2logx$	**Apply (CO3)**	**6**
Q.4	**Solve any two of the following.**		**12**
A)	Find the Fourier series of $f(x)=\frac{1}{2}(\pi-x)$ over $(0,2\pi)$	**Understand (CO4)**	**6**

B)	Find the Fourier series of $f(x)=9-x^2$ over $(-3,3)$	**Understand (CO4)**	**6**
C)	Expand $\pi x - x^2$ as a half range Fourier cosine series for $0 \le x \le \pi$	**Understand (CO4)**	**6**
Q. 5	**Solve any two of the following.**		**12**
A)	If $\varphi = x^2 y + 2xy^2 + 3yz$ then find $\nabla\varphi$ and if $\overline{F} = 2xi - yj - 2zk$ then find $\nabla\cdot\overline{F}$ and $\nabla\times\overline{F}$.	**Remember (CO5)**	**6**
B)	Evaluate $\oint_C \left[(xy+y^2)\,dx + x^2 dy\right]$ by Green's theorem, where C is the boundary of the region bounded by the parabola $y = x^2$ and $y = x$.	**Apply (CO5)**	**6**
C)	Use Gauss divergence theorem to evaluate $\iint_S \overline{F}\cdot ds$ where $\overline{F} = 4x\,i - 2y^2 j + z^2 k$ and S is the surface bounding the region $x^2+y^2=4$, $z=0$ and $z=3$.	**Apply (CO5)**	**6**
	*** **End** ***		

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Winter Examination – (Supplementary) 2023

Course: B. Tech. **Branch : B. Tech (Common to All)** **Semester : II**

Subject Code & Name: Engineering Mathematics-II (BTBS 201)

Max Marks: 60 **Date:15.01.2024** **Duration: 3 Hr.**

Instructions to the Students:

1. *All the questions are compulsory.*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks
Q. 1	**Solve Any Two of the following.**		**12**
A)	Find all the values of $(i)^{\frac{1}{4}}$	**Understand (CO1)**	**6**
B)	If $\tan(\theta + i\phi) = \cos\alpha + i\sin\alpha$, prove that $\phi = \frac{1}{2}\log_e \tan\left(\frac{\pi}{4} + \frac{\alpha}{2}\right)$	**Understand (CO1)**	**6**
C)	If $p\log(a+ib) = (x+iy)\log m$, prove that $\frac{y}{x} = \frac{2\tan^{-1}\frac{b}{a}}{\log(a^2+b^2)}$.	**Understand (CO1)**	**6**
Q.2	**Solve Any Two of the following.**		**12**
A)	Solve: $\cos^2 x\frac{dy}{dx} + y = \tan x$	**Understand (CO2)**	**6**
B)	Solve: $(x^2y - 2xy^2)dx - (x^3 - 3x^2y) = 0$	**Understand (CO2)**	**6**
C)	A coil having resistance of **20Ω** & inductance of **10H** is connected to **100V** supply. Determine the values of current after two seconds	**Application (CO2)**	**6**
Q. 3	**Solve Any Two of the following.**		**12**
A)	Solve: $y'' + 4y' + 13y = 18e^{-2x}$	**Understand (CO2)**	**6**
B)	Solve: $(D^2 + 2D + 1)y = e^{-x}\log x$ by method of variation of parameters	**Understand (CO2)**	**6**
C)	Solve: $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 5y = x^2\cos(\log x)$	**Understand (CO2)**	**6**
Q.4	**Solve Any Two of the following.**		**12**
A)	Obtain the Fourier series to represent $f(x) = \frac{1}{4}(\pi - x)^2$ in the range $(0, 2\pi)$.	**Understand (CO3)**	**6**
B)	Find Fourier series for $f(x) = 9 - x^2$ in the range $(-3, 3)$.	**Understand (CO3)**	**6**
C)	Find half range Fourier cosine series for $f(x) = x, \quad 0 < x < 2$.	**Understand (CO3)**	**6**

Q. 5	**Solve Any Two of the following.**		**12**
A)	Define divergence and Curl of the vector point function. Find $\boldsymbol{div\,\vec{F}}$ and $\boldsymbol{Curl\,\vec{F}}$ if $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$	**Understand (CO4)**	**6**
B)	Verify Green's theorem $\int_c [(x^2 - 2xy)dx + (x^2y + 3)dy]$, where **C** is the boundary of the region bounded by the parabola $y = x^2$ and $y = x$	**Understand (CO5)**	**6**
C)	Verify Stokes' theorem for $\vec{F} = xy^2\hat{\imath} + y\hat{\jmath} + z^2x\hat{k}$ for the surface of the rectangle bounded by $x = 0, y = 0, x = 1, y = 2, z = 0$	**Understand (CO5)**	**6**
	*** **End** ***		

	DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE		
	Summer Examination – 2023		
	Course: B. Tech. **Branch : FE All** **Semester : II**		
	Subject Code & Name: Engineering Mathematics-II (BTBS201)		
	Max Marks: 60 **Date: 12-07-2023** **Duration: 3 Hr.**		
	Instructions to the Students: *1. All the questions are compulsory.* *2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.* *3. Use of non-programmable scientific calculators is allowed.* *4. Assume suitable data wherever necessary and mention it clearly.*		
		(Level/CO)	Marks
Q. 1	**Solve Any Two of the following.**		**12**
A)	If $\tan(A+iB)=x+iy$ then show that i) $\tan 2A=\frac{2x}{1-x^2-y^2}$ ii) $\tanh 2B=\frac{2y}{1+x^2+y^2}$	**Understand (CO1)**	**6**
B)	Show that the roots of $x^5=1$ are $1,\alpha,\alpha^2,\alpha^3,\alpha^4$ and hence prove that $(1-\alpha)(1-\alpha^2)(1-\alpha^3)(1-\alpha^4)=5$	**Understand (CO1)**	**6**
C)	Prove that $\tan\left[i\log\left(\frac{a-ib}{a+ib}\right)\right]=\frac{2ab}{a^2-b^2}$	**Understand (CO1)**	**6**
Q.2	**Solve Any Two of the following.**		**12**
A)	Solve $\frac{dy}{dx}+x\sin 2y=x^3\cos^2 y$	**Understand (CO2)**	**6**
B)	Solve $y\,dx-x\,dy+\log x\;dx=0$	**Understand (CO2)**	**6**
C)	A constant electromotive force E volts is applied to a current containing a constant resistance R ohm in series and a constant inductance L Henries. If the initial current is zero, show that the current builds up to half its theoretical maximum in $\left(\frac{L}{R}\log 2\right)$ seconds.	**Apply (CO2)**	**6**
Q. 3	**Solve Any Two of the following.**		**12**
A)	Solve $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+y=e^x+xe^x\cos x$	**Understand (CO3)**	**6**
B)	Solve $(D^2+2D+1)y=e^{-x}\log x$ by method of variation of parameters	**Understand (CO3)**	**6**
C)	Solve $x^2\frac{d^2y}{dx^2}-2x\frac{dy}{dx}+2y=x^2$	**Understand (CO3)**	**6**
Q.4	**Solve Any Two of the following.**		**12**
A)	Find the Fourier series of the function $f(x)=x$ in the interval $(0,2\pi)$.	**Understand (CO4)**	**6**
B)	Find the Fourier series of $f(x)=x^2$ in the interval $-\pi<x<\pi$ and hence show that $\frac{\pi^2}{6}=\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+\cdots$	**Understand (CO4)**	**6**

C)	If $f(x) = \begin{cases} x & , \quad 0 < x < \frac{\pi}{2} \\ \pi - x & , \quad \frac{\pi}{2} < x < \pi \end{cases}$ then find half range Fourier sine series Hence show that $f(x) = \frac{4}{\pi}\left(\sin x + \frac{\sin 3x}{3^2} + \frac{\sin 5x}{5^2} + \cdots \quad \right)$	**Understand (CO4)**	**6**
Q. 5	**Solve Any Two of the following.**		**12**
A)	If $\bar{r} = xi + yj + zk$ and $r = \lvert\bar{r}\rvert$ then Find $\nabla \cdot \bar{F}$, where $\bar{F} = \left(\frac{x}{r}\right) i + \left(\frac{y}{r}\right) j + \left(\frac{z}{r}\right) k$	**Understand (CO5)**	**6**
B)	Verify Green's theorem for $\oint_C ((xy + y^2)dx + x^2dy)$ where C is bounded by $y = x$ and $y = x^2$	**Understand (CO5)**	**6**
C)	Verify the Stokes theorem for $\bar{F} = x^2 i + xyj$ over the square in the plane $z = 0$ bounded by the lines $x = 0, x = a, y = 0$ and $y = a$	**Apply (CO5)**	**6**
	*** **End** ***		

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,
LONERE – RAIGAD 402 103
Summer End Semester Examination –2022

Branch: B. Tech. (Common to all) **Semester: II**

Subject with Subject Code: Engineering Mathematics – II (BTBS 201) **Marks: 60**

Date: 17/08/2022 **Time: 3.45 Hrs.**

Instructions to the Students

1. Illustrate your answers with neat sketches, diagrams, etc., wherever necessary.
2. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.

Q. 1

(a) If the sum and product of two complex numbers are real, show that those two numbers must be either real or conjugate. [4 *Marks*]

(b) Solve the equation $\boldsymbol{x^6 - i = 0}$. [4 *Marks*]

(c) If $\tan(A + iB) = x + iy$, prove that

(i) $\tan 2A = \frac{2x}{1-x^2-y^2}$ (ii) $\tanh 2B = \frac{2y}{1+x^2+y^2}$. [4 *Marks*]

Q. 2

(a) Solve: $\cos^2 x \frac{dy}{dx} + y = \tan x$. [4 *Marks*]

(b) Solve: $(x^2 + y^2)dx - xy\,dy = 0$. [4 *Marks*]

(c) Solve: $\frac{dy}{dx} + x \sin 2y = x^3 \cos^2 y$. [4 *Marks*]

Q. 3 Solve any THREE:

(a) Solve $(D^6 - D^4)y = x^2$. [4 *Marks*]

(b) Solve $(D^2 - 2D + 1)y = x\,e^x \cos x$. [4 *Marks*]

(c) Solve by the method of variation of parameters: $\frac{d^2y}{dx^2} + y = \operatorname{cosec} x$. [4 *Marks*]

(d) Solve: $x^2 \frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 5y = x^2 \sin(\log x)$. [4 *Marks*]

Q. 4 Solve any TWO:

(a) Find the Fourier series of the function $\boldsymbol{f(x) = x}$ in the interval $(\boldsymbol{0, 2\pi})$. [6 *Marks*]

(b) Find the Fourier series expansion for the function $\boldsymbol{f(x) = x - x^2}$ in $\boldsymbol{-1 < x < 1}$. [6 *Marks*]

(c) Expand the function $\boldsymbol{f(x) = \pi x - x^2}$ in a half-range sine series in the interval $(\boldsymbol{0, \pi})$. [6 *Marks*]

Q. 5 Solve any THREE

(a) Find $\boldsymbol{\nabla \cdot \vec{F}}$, where $\vec{F} = \left(\frac{x}{r}\right)\hat{\boldsymbol{\imath}} + \left(\frac{y}{r}\right)\hat{\boldsymbol{\jmath}} + \left(\frac{z}{r}\right)\hat{\boldsymbol{k}}$. [4 *Marks*]

(b) Find **curl** $\vec{\boldsymbol{F}}$**,** where $\vec{\boldsymbol{F}} = \boldsymbol{\nabla(x^3 + y^3 + z^3 - 3xyz)}$. [4 *Marks*]

(c) If $\vec{r}$ is a position vector with $\boldsymbol{r} = |\vec{r}|$, show that

$\boldsymbol{\nabla^2 r^n = n(n+1)r^{n-2}}$. [4 *Marks*]

(d) Verify the Green's theorem for $\int_C \{(\boldsymbol{xy + y^2})\boldsymbol{dx} + \boldsymbol{x^2 dy}\}$

where C is bounded by $\boldsymbol{y = x}$ and $\boldsymbol{y = x^2}$. [4 *Marks*]

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DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,
LONERE – RAIGAD -402 103
Semester Winter Examination – December - 2019

Branch: B. Tech. (Common to all) **Semester:- II**

Subject with Subject Code:- Engineering Mathematics – II (MATH 201) **Marks: 60**

Date:- 09/12/2019 **Time:- 3 Hr.**

Instructions to the Students

1. Attempt **any five** questions of the following.
2. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
3. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

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Q.1

(a) Find all the values of $(i)^{\frac{1}{4}}$. [4 Marks]

(b) If $\tan(A+iB) = (x+iy)$, prove that

(i) $\tan 2A = \frac{2x}{1-x^2-y^2}$ (ii) $\tan h2B = \frac{2y}{1+x^2+y^2}$. [4 Marks]

(c) Prove that $\log(1+e^{2i\theta}) = \log(2\cos\theta) + i\theta$. [4 Marks]

Q.2

(a) Solve: $(x^2 - y^2)dx = 2xy\,dy.$ [4 Marks]

(b) Solve: $(y + \log x)dx - (x)dy = 0.$ [4 Marks]

(c) Two particles fall freely, one in a medium whose resistance is equal to k times the velocity and other in a medium whose resistance is equal to k times the square of the velocity. If V_1 and V_2 are their maximum velocities respectively, show that $V_1 = V_2^2$. [4 Marks]

Q.3 Solve any TWO:

(a) Solve: $(D^2 - 3D + 2)y = e^{3x}$. [6 Marks]

(b) Solve: $(D^2 - 2D + 1)y = x\,e^x \sin x$. [6 Marks]

(c) Solve by the method of variation of parameters

$\frac{d^2y}{dx^2} + y = \operatorname{cosec} x$. [6 Marks]

Q.4

(a) Find the Fourier series of $f(x) = x^2$ in the interval $(0\,,\ 2\pi)$, and hence deduce that

$$\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots$$

[6 $Marks$]

(b) Expand the function $f(x) = \pi x - x^2$ in a half – range sine series in the interval $(0, \pi)$.

[6 $Marks$]

Q.5

(a) The necessary and sufficient condition for vector $\vec{F}(t)$ to have constant magnitude is $\vec{F}(t) \cdot \frac{d\vec{F}(t)}{dt} = 0$.

[6 $Marks$]

(b) A point moves in a plane so that its tangential and normal components of acceleration are equal and angular velocity of the tangent is constant and equal to ω. Show that the path is equiangular spiral $\omega s = Ae^{\omega t} + B$, where A and B are the constant.

[6 $Marks$]

Q.6

(a) Find Curl $\vec{F}$, where $\vec{F} = \nabla\,(x^3 + y^3 + z^3 - 3xyz)$. [4 $Marks$]

(b) If $\vec{r}$ is a position vector with $r = |\vec{r}|$, show that

$\nabla \times (r^n\,\vec{r}) = 0$. [4 $Marks$]

(c) Show that $\iiint_v \frac{dv}{r^2} = \iint_s \frac{\vec{r}\,.\,\hat{n}}{r^2}\,ds$. [4 $Marks$]

********************************Paper End**********************************

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE – RAIGAD
Semester Winter Examination – December - 2019

Branch: B. Tech. (Common to all) **Semester: II**

Subject with Subject Code: Engineering Mathematics – II (BTMA 201) **Marks: 60**

Date: 09.12.2019 **Time: 3 Hrs.**

Instructions to the Students

1. Attempt **any five** questions of the following.
2. Illustrate your answers with neat sketches, diagrams, etc., wherever necessary.
3. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.

Q. 1

(a) If the sum and product of two complex numbers are real, show that those two numbers must be either real or conjugate. [4 *Marks*]

(b) Solve the equation $x^6 - i = 0$. [4 *Marks*]

(c) If $\tan(A + iB) = x + iy$, prove that

(i) $\tan 2A = \frac{2x}{1-x^2-y^2}$ (ii) $\tanh 2B = \frac{2y}{1+x^2+y^2}$. [4 *Marks*]

Q. 2

(a) Solve: $\cos^2 x \frac{dy}{dx} + y = \tan x$. [4 *Marks*]

(b) Solve: $(x^2 + y^2)dx - xy\, dy = 0$. [4 *Marks*]

(c) A body falling from rest is subjected to the force of gravity and an air resistance of $\left(\frac{n^2}{g}\right)$ times square of the velocity. Show that the distance travelled by the body in t seconds is $\frac{g}{n^2} \log \cos h\,(nt)$.

[4 *Marks*]

Q. 3 Solve any THREE:

(a) Solve $(D^6 - D^4)y = x^2$. [4 *Marks*]

(b) Solve $(D^2 - 2D + 1)y = x\, e^x \cos x$. [4 *Marks*]

(c) Solve by the method of variation of parameters: $\frac{d^2y}{dx^2} + y = \operatorname{cosec} x$. [4 *Marks*]

(d) Solve: $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 5y = x^2 \sin(\log x)$. [4 *Marks*]

Q. 4 Solve any TWO:

(a) Find the Fourier series of the function $\boldsymbol{f(x) = x}$ in the interval $(\mathbf{0}, \boldsymbol{2\pi})$. [6 $Marks$]

(b) Find the Fourier series expansion for the function $\boldsymbol{f(x) = x - x^2}$ in $\boldsymbol{-1 < x < 1}$. [6 $Marks$]

(c) Expand the function $f(x) = \pi x - x^2$ in a half-range sine series in the interval $(0, \pi)$. [6 $Marks$]

Q. 5 Solve any THREE

(a) Find the value of the constant λ such that the vector field defined by

$\vec{\boldsymbol{F}} = (\boldsymbol{2x^2y^2 + z^2})\hat{\imath} + (\boldsymbol{3xy^3 - x^2z})\hat{\jmath} + (\boldsymbol{\lambda xy^2z + xy})\hat{\boldsymbol{k}}$ is solenoidal. [4 $Marks$]

(b) Find $\boldsymbol{\nabla \cdot \vec{F}}$, where $\vec{\boldsymbol{F}} = \left(\frac{x}{r}\right)\hat{\imath} + \left(\frac{y}{r}\right)\hat{\jmath} + \left(\frac{z}{r}\right)\hat{\boldsymbol{k}}$. [4 $Marks$]

(c) Find **curl** $\vec{\boldsymbol{F}}$, where $\vec{\boldsymbol{F}} = \boldsymbol{\nabla(x^3 + y^3 + z^3 - 3xyz)}$. [4 $Marks$]

(d) If $\vec{r}$ is a position vector with $\boldsymbol{r = |\vec{r}|}$, show that

$\boldsymbol{\nabla^2 r^n = n(n+1)r^{n-2}}$. [4 $Marks$]

Q. 6:

(a) Find the values of the line integral $\int_C \vec{\boldsymbol{F}} \cdot \boldsymbol{d\vec{r}}$ along the path

$\boldsymbol{y^2 = x}$ joining the points $(\mathbf{0}, \mathbf{0})$ and $(\mathbf{1,1})$ provided that $\vec{\boldsymbol{F}} = \boldsymbol{x^2}\hat{\imath} + \boldsymbol{y^2}\hat{\jmath}$. [4 $Marks$]

(b) Verify the Green's theorem for $\int_C \{(\boldsymbol{xy + y^2})\boldsymbol{dx} + \boldsymbol{x^2dy}\}$

where C is bounded by $\boldsymbol{y = x}$ and $\boldsymbol{y = x^2}$. [4 $Marks$]

(c) Show that $\iiint_v \frac{dv}{r^2} = \iint_s \frac{\vec{r} \cdot \hat{n}}{r^2}\, \boldsymbol{ds}$. [4 $Marks$]

**************************Paper End******************************

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination – Summer 2019

Course: B. Tech in All Branches **Sem: II**

Subject Name: Engineering Mathematics II **Subject Code:** BTMA201

Max Marks:60 **Date:13/05/2019** **Duration: 3 Hr.**

Instructions to the Students:

1. *Solve **ANY FIVE** questions out of the following.*
2. *Use of non-programmable scientific calculators is allowed.*
3. *Assume suitable data wherever necessary and mention it clearly.*
4. *Figures to the right indicate full marks.*

Q. 1 Solve Any Three of the following. **12**

A) If $\arg(z+1)=\frac{\pi}{6}$ and $\arg(z-1)=\frac{2\pi}{3}$, find z.

B) If $\alpha=1+i\ ,\ \beta=1-i\ and\ \cot\theta=x+1$, prove that

$$(x+\alpha)^n+(x+\beta)^n=(\alpha-\beta)\sin(n\theta)\,cosec^n(\theta).$$

C) Show that all the roots of $(x+1)^6+(x-1)^6=0$ are given by $-i\cot\left(\frac{(2k+1)\pi}{12}\right)$, k=0,1,2,3,4,5.

D) If $\tan(\theta+i\emptyset)=\cos\alpha+i\sin\alpha$, prove that

I. $\theta=\frac{n\pi}{2}+\frac{\pi}{4}$.

II. $\emptyset=\frac{1}{2}\log_e\tan\left(\frac{\pi}{4}+\frac{\alpha}{2}\right)$.

Q.2 Solve Any Three of the following. **12**

A) Solve $\frac{dy}{dx}-\frac{\tan y}{1+x}=(1+x)e^x\sec y$.

B) Solve $ydx-xdy+\log x\,dx=0$.

C) Find the orthogonal trajectories of $\frac{x^2}{a^2}+\frac{y^2}{b^2+\lambda}=1\ ,\ where\ \lambda$ is a parameter.

D) A constant electromotive force E volts is applied to a circuit containing a constant resistance R ohm in series and a constant inductance L henries. If the initial current is zero , show that the current builds up to half its theoretical maximum in (L log2)/R sec.

P.T.O.

Q.3) Solve Any Three of the following. **12**

A) Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x$.

B) Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 25y = e^{2x} + \sin x + x$.

C) Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{e^x}$.

D) Solve $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 5y = x^2 \sin(\log x)$.

Q.4 Solve Any Two of the following. **12**

A) Find the Fourier series for $f(x) = \sqrt{1 - \cos x}$ in the range $(0,2\pi)$.Prove that $\frac{1}{2} = \sum_{n=1}^{\infty} \frac{1}{4n^2-1}$.

B) Obtain the Fourier series for $f(x)$ given by

$$f(x) = \begin{cases} 1 + \frac{2x}{\pi} , & -\pi \le x \le 0 \\ 1 - \frac{2x}{\pi} , & 0 \le x \le \pi . \end{cases}$$

Hence deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots \ldots \ldots = \frac{\pi^2}{8}$.

C) If $f(x) = 2x - x^2 \; in \; 0 \le x \le 2$, show that $f(x) = \frac{2}{3} - \sum_{n=1}^{\infty} \frac{4}{n^2\pi^2} \cos(n\pi x)$.

Q.5 Solve Any Three of the following. **12**

A) Find the directional derivatives of $\emptyset = e^{2x} \cos yz$ at (0,0,0) in the direction of the tangent to the curve $x = a \sin t , y = a \cos t , z = at$ at $t = \frac{\pi}{4}$.

B) Find the cosine of the angle between the normals to the surfaces $x^2y + z = 3$ and $x \log z - y^2 = 4$ at the point of intersection $p(-1,2,1)$.

C) Find $curl\, \vec{F}$, where $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$.

D) If $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$, find $\vec{r}.\nabla\emptyset \; for \; \emptyset = x^3 + y^3 + z^3 - 3xyz$.

Q. 6 Solve Any Two of the following. **12**

A) Evaluate $\oint_C \vec{F} . d\vec{r}$ where C is the square formed by the lines $y = \pm 1 \; and \quad x = \pm 1$, and $\vec{F} = (x^2 + xy)\hat{\imath} + (x^2 + y^2)\hat{\jmath}$.

B) Verify the Green's theorem for $\int_C \{(xy + y^2)dx + x^2dy\}$ where C is bounded by $y = x$ and $\mathrm{dy} = x^2$.

C) Evaluate $\iint_S \{2x^2ydydz - y^2dzdx + 4xz^2dxdy\}$ over the curved surface of the cylinder $y^2 + z^2 = 9$, bounded by $x = 0$ and $x = 2$.

***** End *****

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End – Semester Examination (Supplementary): May 2019

Branch: B. Tech (Common to all) **Semester:** II

Subject with code: Engineering Mathematics – II (MATH 201) **Marks:** 60

Date: 29.05.2019 **Duration:** 03 Hrs.

INSTRUCTION: Attempt any **FIVE** of the following questions. All questions carry equal marks.

Q.1

(a) Find all the values of $(i)^{\frac{1}{4}}$ [4 *Marks*]

(b) If $\sin(\theta + i\phi) = \cos\alpha + i\sin\alpha$, prove that $\cos^2\theta = \pm\sin\alpha$. [4 *Marks*]

(c) Prove that $\tan\left[i \log\frac{a-ib}{a+ib}\right] = \frac{2ab}{a^2-b^2}$ [4 *Marks*]

Q.2

(a) Solve: $\cos^2 x\frac{dy}{dx} + y = \tan x.$ [4 *Marks*]

(b) Solve: $(x^2 + y^2)dx - (xy)dy = 0$. [4 *Marks*]

(c) Two particles fall freely, one in a medium whose resistance is equal to k times the velocity and other in a medium whose resistance is equal to k times the square of the velocity. If V_1 and V_2 are their maximum velocities respectively, show that $V_1 = V_2^2$. [4 *Marks*]

Q.3 Solve any TWO:

(a) Solve: $(D^2 - 3D + 2)y = e^{3x}$. [6 *Marks*]

(b) Solve: $(D^6 - D^4)y = x^2$. [6 *Marks*]

(c) Solve by the method of variation of parameters

$$\frac{d^2y}{dx^2} + y = \operatorname{cosec} x.$$ [6 *Marks*]

Q.4

(a) Find the Fourier series of $f(x) = x^2$ in the interval $(-\pi,\ \pi)$, and hence deduce that

$$\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \cdots$$ [6 *Marks*]

(b) If $f(x) = 2x - x^2$ in $0 \le x \le 2$, show that $f(x) = \frac{2}{3} - \sum_{n=1}^{\infty} \frac{4}{n^2\pi^2} \cos n\pi x$.

[6 *Marks*]

Q.5

(a) The necessary and sufficient condition for vector $\vec{F}(t)$ to have constant magnitude is

$\vec{F}(t) . \frac{d\vec{F}(t)}{dt} = 0$. [6 *Marks*]

(b) Show that the acceleration of the point moving along the curve with uniform speed is $\varrho \left(\frac{d\psi}{dt}\right)^2$ along the normal.

[6 *Marks*]

Q.6

(a) Find $\nabla . \vec{F}$, where $\vec{F} = \nabla\left(x^3 + y^3 + z^3 - 3xyz\right)$. [4 *Marks*]

(b) If $\vec{r}$ is a position vector with $r = |\vec{r}|$, show that

$\nabla . (r^n\, \vec{r}) = (n + 3)r^n$. [4 *Marks*]

(c) Show that $\iiint_v \frac{dv}{r^2} = \iint_s \frac{\vec{r}\,.\,\hat{n}}{r^2}\, ds$. [4 *Marks*]

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Dr. Babasaheb Ambedkar Technological University, Lonere-Raigad
Supplementary Examinations Nov 2018

Course: B. Tech (All Courses) **Semester: I/II**
Subject Name with Subject Code: Engineering Mechanics (ME102/ME202)
Date: 28/11/2018 Time: 3 Hours Max Marks: 60

Instructions to the Students:

1. *Attempt ANY FIVE Questions from Question No 1 to Question No 6.*
2. *Illustrate your answers with neat sketches, diagrams etc. wherever necessary.*
3. *Necessary data is given in the respective questions. If such data is not given, it means that the knowledge of that part is a part of examination.*
4. *Use of non-programmable scientific calculators is allowed.*

Q.1. Attempt the following. (06X2=12)

A) What do you understand by resolution of forces and calculate the resultant of following forces shown in figure 1?

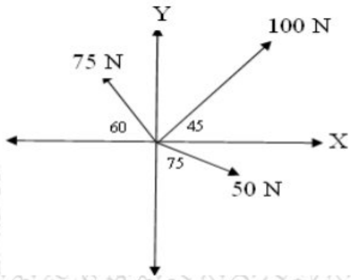

Figure1

B) What are the components of accelerations for the curvilinear motion? How will you calculate these components? Explain with some examples.

Q.2. Attempt the following. (06X2=12)

A) Define constraint, action, reaction and types of supports and support reactions with free body diagram.

B) Three identical right circular cylinders A, B and C, each weight W are arranged on smooth inclined surface as shown in figure 2. Determine the least value of angle Θ that will prevent the arrangement from collapsing.

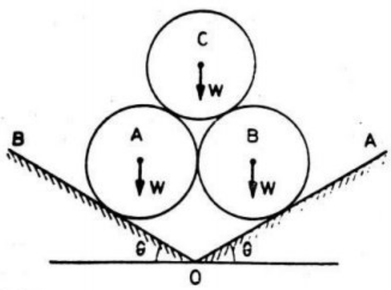

Figure 2

Q.3. Attempt the following. (06X2=12)

A) Three spherical balls of mass 2 kg, 6 kg and 12 kg are moving in the same directions with velocities 12 m/s, 4 m/s and 2 m/s respectively. If the ball of mass 2 kg impinges with the ball of mass 6 kg which in turn impinges with the ball of mass 12 kg prove that the balls of masses 2 kg and 6 kg will be brought to rest by the impact. Assume the balls to be perfectly elastic.

P.T.O.

B) What do you understand by trusses and frames? How will you determine the axial forces in the members? Explain method of Joints and method of sections.

Q.4. Attempt the following. (06X2=12)

A) What force P must be applied to the weightless wedges shown in fig 3. to start them under the 1000N block? The angle of friction for all contact surfaces is 10 degree.

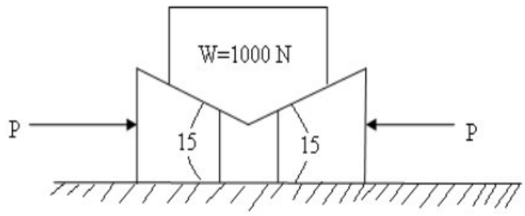

Figure 3

B) Locate the centroid of the shaded area obtained by removing semicircle of diameter *'a'* from a quadrant of a circle of radius *'a'* as shown in Figure 4.

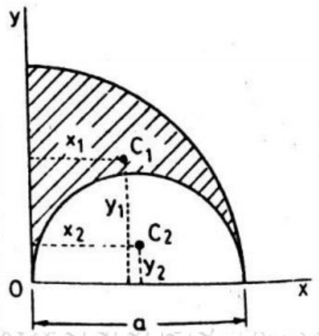

Figure 4

Q.5. Attempt the following. (06X2=12)

A) Explain the direct central impact, nature of impact and coefficient of restitution.

B) A gun of mass 3000 kg fires horizontally a shell of mass 50 kg with a velocity of 300 m/s. What is the velocity with which the gun will recoil? Also determine the uniform force required to stop the gun in 0.6 m. In how much time it will stop.

Q.6. Attempt the following.

A) Define and explain the D'Alemberts principle. Write and elaborate the equation of this, for rectilinear and curvilinear motion. (04)

B) If the coefficient of kinetic friction is 0.25 under each body in the system shown in fig. 5, how far and in what direction will body B move in 5 sec. starting from rest. Pulleys are frictionless. (08)

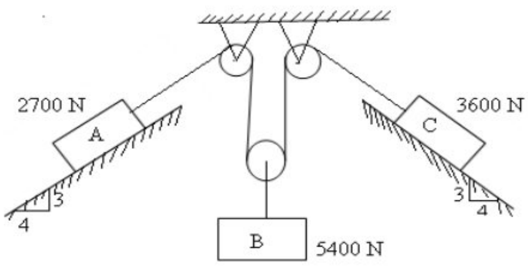

Figure 5

END

Dr. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination: May 2018

Branch:	B.Tech (Common to all)	**Semester:**	II
Subject with code:	Engineering Mathematics-II (MATH 201)	**Marks:**	60
Date:	14/05/2018	**Time:**	03 Hrs.

INSTRUCTION: Attempt any FIVE of the following questions. All questions carry equal marks.

Q.1 Solve any three

(a) If $\arg(z+1)=\dfrac{\pi}{6}$ *and* $\arg(z-1)=\dfrac{2\pi}{3}$, find z. [4 Marks]

(b) Solve: $x^7+x^4+x^3+1=0$. [4 Marks]

(c) If $\cos(\theta+i\phi)=\mathrm{Re}^{i\alpha}$, show that $\phi=\dfrac{1}{2}\log_e\left(\dfrac{\sin(\theta-\alpha)}{\sin(\theta+\alpha)}\right)$. [4 Marks]

(d) Prove that $\tan\left\{i\log\left(\dfrac{a-ib}{a+ib}\right)\right\}=\dfrac{2ab}{a^2-b^2}$. [4 Marks]

Q.2 Solve any three.

(a)Solve $(4x-6y-1)dx+(3y-2x-2)dy=0$. [4 Marks]

(b) Solve $\dfrac{dy}{dx}=\dfrac{y+1}{(y+2)e^y-x}$. [4 Marks]

(c) Solve $(1+y^2)+(x-e^{\tan^{-1}y})\dfrac{dy}{dx}=0$. [4 Marks]

(d) Determine the charge and current at any time 't' in a series R-C circuit with $R=10\Omega$, $C = 2 \times 10^{-4}$ F and E = 100V, given that $q(0)=0$. [4 Marks]

Q.3. Solve any three.

(a) Solve $\dfrac{d^2y}{dx^2}+6\dfrac{dy}{dx}+9y=5^x-\log 2$. [4 Marks]

(b) Solve $\dfrac{d^2y}{dx^2}-2\dfrac{dy}{dx}+5y=25x^2$. [4 Marks]

(c) Solve $(D^2+2D+1)y=e^{-x}\log x$ by method of variation of parameters. [4 Marks]

(d) Solve $x^2y''-3xy'+5y=x^2\sin(\log x)$. [4 Marks]

Q.4. (a) Obtain the Fourier series expansion of $\sqrt{1-\cos x}$ in the interval $0 \le x \le 2\pi$. [6 Marks]

(b) Find the Half-range co-sine series for $f(x) = \begin{cases} \frac{1}{4} - x & 0 < x < \frac{1}{2} \\ x - \frac{3}{4} & \frac{1}{2} < x < 1 \end{cases}$. [6 Marks]

Q.5. (a) If a particle describes the curve $r = 2a\cos\theta$ with constant angular speed ω, find the radial and transverse components of velocity and acceleration. [4 Marks]

(b) For the curve $x = t^3 + 1, y = t^2, z = t$, find the magnitude of tangential and normal components of acceleration at $t = 1$. [4 Marks]

(c) If the particle describes the cardioid $r = a(1-\cos\theta)$ under a force to the pole, show that the force is proportional to the inverse of the 4^{th} power of the distance. [4 Marks]

Q.6. (a) Find the directional derivative of $\phi = 5x^2y - 5y^2z + 2.5z^2x$ at the point $p(1,1,1)$ in the direction of the line $\frac{x-1}{2} = \frac{y-3}{-2} = z$. [4 Marks]

(b) If $\vec{F} = (ax+3y+4z)\hat{i} + (x-2y+3z)\hat{j} + (3x+2y-z)\hat{k}$ is solenoidal, find the value of 'a'. [4 Marks]

(c) Find the total work done in moving a particle in the force field, given by $\vec{F} = 3xy\,\hat{i} - 5z\,\hat{j} + 10x\,\hat{k}$ along the curve $x = t^2 + 1, y = 2t^2, z = t^3$ from $t = 1$ to $t = 2$. [4 Marks]

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DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,
LONERE – RAIGAD -402 103
Mid Semester Examination – Summer - 2018

Branch: F.Y. B. Tech (Group A/Group B) **Sem.:- II**

Subject with Subject Code:- Engineering Mathematics –II (MATH 201)

Marks: 20

Date:-12/03/2018 **Time:- 1 Hr.**

Instructions:- 1. All Questions are Compulsory.
2. Use of Non-programmable calculator is allowed.
3. Figures to the right indicate full marks.

(Marks)

Q.No.1 Attempt the following **(06)**

a) The real part of $\frac{2+3i}{3-4i}$ is,

i) $\frac{-6}{25}$ ii) $\frac{6}{25}$ iii) $\frac{17}{18}$ iv) None

b) If z_1 and z_2 are any two complex numbers such that $z = z_1 z_2$ then $|z| =$ -----

i) $|z_1||z_2|$ ii) $\frac{|z_1|}{|z_2|}$ iii) $|z_1| = |z_2|$ iv) $|z_1| + |z_2|$

c) Integrating factor of differential equation $\frac{dx}{dy} + \frac{3x}{y} = \frac{1}{y^2}$ is -------

i) e^{y^3} ii) y^3 iii) x^3 iv) None

d) The condition of exact differential equation is ---------

i) $\frac{dM}{dy} = \frac{dN}{dx}$ ii) $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$ iii) $\frac{\partial M}{\partial x} = \frac{\partial N}{\partial y}$ iv) $\frac{dM}{dx} = \frac{dN}{dy}$

e) The solution of differential $(D^2 - 8D + 16)y = 0$ is -----------

i) $c_1 e^{4x} + c_2 e^{4x}$ ii) $c_1 e^{-4x} + c_2 e^{4x}$ iii) $(c_1 + c_2 x)e^{4x}$ iv) $c_1 \cos 4x + c_2 \sin 4x$

f) The particular integral of linear differential equation $(D-1)^3 y = 2^x$ is -------

i) $(\log 2 - 1)^3$ ii) $(-1)^3 2^x$ iii) 2^x iv) $\frac{2^x}{(\log 2 - 1)^3}$

Q. No. 2 Attempt any one of the following: (06)

a) Using De-Moivier's theorem Prove that,

$$\frac{\sin 6\theta}{\sin 2\theta} = 16\cos^4\theta - 16\cos^2\theta + 3$$

b) A coil having resistance of R, inductance L, and battery E are connected in series , Prove that $i = \frac{E}{R}(1 - e^{\frac{-R}{L}t})$ and if $R = 20\Omega, L = 10H$ and $E = 100V$ then find current after two seconds.

Q. No 3. Attempt any two of the following (08)

a) Solve: $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = e^{-2x}\sin 2x$.

b) Solve: $(2x+1)^2\frac{d^2y}{dx^2} - 6(2x+3)\frac{dy}{dx} + 16y = 8(2x+1)^2$.

c) If $\sin(\theta + i\phi) = \cos\alpha + i\sin\alpha$ then prove that $\cos^2\theta = \pm\sin\alpha$.

d) Solve: $\frac{dy}{dx} + y\tan x = y^3\sec x$.
