DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Bachelor of Technology (Computer Science and Engineering) SEMESTER - 2 Summer 2025 (Regular)

Course :Bachelor of Technology (Computer Science and Engineering) Branch : Engineering and Technology

Semester : SEMESTER - 2

Subject Code & Name: 24AF1000BS201 - ENGINEERING MATHEMATICS – II

Time : 3 Hours] [Total Marks : 60

Instructions to the Students:

1.Each question carries 12 marks.

2.Question No. 1 will be compulsory and include objective-type questions.

3.Candidates are required to attempt any four questions from Question No. 2 to Question No.6

4.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.

5.Use of non-programmable scientific calculators is allowed.

6.Assume suitable data wherever necessary and mention it clearly.

Q1. Objective type questions. (Compulsory Question) 12

1 If $z = -1 - i$, then its amplitude is

(a) $\frac{\pi}{4}$ (b) $-\frac{\pi}{4}$

(c) $\frac{5\pi}{4}$ (d) $-\frac{5\pi}{4}$.

2 If $z = \cos\theta + i\sin\theta$, then the value of $z^n - \frac{1}{z^n}$ is

(a) $2i\sin n\theta$ (b) $2i\cos n\theta$

(c) $\sin n\theta$ (d) $\cos n\theta$.

3 The module of $\left(\sqrt{i}\right)^{\sqrt{i}}$ is equal to

(a) $e^{\frac{\pi}{4\sqrt{2}}}$ (b) $e^{\frac{\pi}{2\sqrt{2}}}$

(c) $e^{-\frac{\pi}{4\sqrt{2}}}$ (d) $e^{-\frac{\pi}{2\sqrt{2}}}$.

4 The integrating factor of the differential equation $\frac{dy}{dx} + y\cos x = \frac{\sin 2x}{2}$ is

(a) $e^{\sin x}$ (b) $e^{\sin^2 x}$

(c) $e^{\sin 2x}$ (d) $e^{\cos x}$

5 The general solution of $\frac{1}{x^2y^2}(y\,dx + x\,dy)$ is

(a) $x + y = c$

(b) $x - y = c$

(c) $xy = c$

(d) $\frac{1}{x^2y^2}$

6 The solution of $(D^2 - 2D + 1)y = 0$ is

(a) $(c_1 + c_2x)e^x$

(b) $(c_1 + c_2x)e^{-x}$

(c) $(c_1 - c_2x)e^x$

(d) $c_1e^x + c_2\,e^{-x}$

7 The complimentary function of the differential equation $y'' - 3y' + 2y = 12$ is

(a) $c_1e^x + c_2e^{2x}$

(b) $c_1e^x + c_2e^{-2x}$

(c) $c_1e^{-x} + c_2e^{2x}$

(d) $c_1e^{-x} + c_2e^{-2x}$

8 The particular integral of the differential equation $(D^2 - 4)y = \sin 3x$ is

(a) $-\frac{1}{13}\sin(3x)$

(b) $\frac{1}{13}\sin(3x)$

(c) $\frac{1}{5}\sin(3x)$

(d) $-\frac{1}{5}\sin(3x)$

9 If $f(x) = x^2$ in $-2 < x < 2$, then the Fourier constant a_n is equal to

(a) $\int_0^2 x^2\frac{\cos(n\pi x)}{2}dx$

(b) $\int_0^2 x^2\frac{\sin(n\pi x)}{2}dx$

(c) $\int_0^2 x^2\cos(nx)\,dx$

(d) $\int_0^2 x^2\sin(nx)\,dx$

10 For the half-range sine series for $f(x) = 1$ in $(0,\pi)$ the value of b_n is

(a) $\frac{2(1+\cos n\pi)}{n\pi}$

(b) $\frac{2(1-\cos n\pi)}{n\pi}$

(c) $\frac{2(1+\sin n\pi)}{n\pi}$

(d) $\frac{2(1-\sin n\pi)}{n\pi}$

11 Div$(\vec{r})$, where $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, is equal to

(a) 0

(b) 1

(c) 3

(d) -3

12 The value of $\iint_S (yz\,dy\,dz + zx\,dz\,dx + xy\,dx\,dy)$, where S is the surface of the sphere $x^2 + y^2 + z^2 = 1$, is

(a) 0

(b) 4π

(c) $\frac{4\pi}{3}$

(d) π

Q2. Solve the following.

A) If $\alpha, \alpha^2, \alpha^3, \alpha^4$ are roots of the equation $x^5 - 1 = 0$, then show that: 6

$$(1-\alpha)(1-\alpha^2)(1-\alpha^3)(1-\alpha^4) = 5.$$

B) Prove that: $\tan\left[i \log\frac{a-ib}{a+ib}\right] = \frac{2ab}{a^2-b^2}$. 6

Q3. Solve the following.

A) Solve: $y\,dx - x\,dy + \log(x)\,dx = 0$. 6

B) Solve: $(1+y^2)dx + \left(x - e^{\tan^{-1}y}\right)dy = 0$. 6

Q4. Solve Any Two of the following.

A) Solve: $\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 2y = e^x + \cos x$. 6

B) Solve the following differential equation by the method of variation of parameters: 6

$$y'' - 2y' + 2y = e^x \tan x$$

C) Solve: $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 5y = x^2 \sin(\log x)$. 6

Q5. Solve Any Two of the following.

A) Find the Fourier series expansion of $f(x) = 4 - x^2$ in the range $(0, 2)$. 6

B) Find the Fourier series for the function $f(x) = x^3$ in the interval $(-\pi, \pi)$. 6

C) Obtain the half-range Fourier cosine series for the function $f(x) = \pi - x$ in $0 \le x \le \pi$. 6

Q6. Solve Any Two of the following.

A) Find $\nabla \cdot \vec{F}$ and $\nabla \times \vec{F}$, where $\vec{F} = \text{grad}\,(x^3 + y^3 + z^3 - 3xyz)$. 6

B) If $\vec{r}$ is the position vector and r is its magnitude, then prove that: 6

(i) $\nabla \cdot (r^n \vec{r}) = (n+3)r^n$

(ii) $\nabla \times (r^n \vec{r}) = 0$.

C) Apply Stokes' theorem to evaluate $\int_C [4y\,dx + 2z\,dy + 6y\,dz]$, where C is the curve of intersection of $x^2 + y^2 + z^2 = 6z$ and $z = x + 3$. 6

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

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

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

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 $\boldsymbol{\tan(A + iB) = x + iy}$, prove that

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

Q. 2

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

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

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

[4 *Marks*]

Q. 3 Solve any THREE:

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

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

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

(d) Solve: $\boldsymbol{x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 5y = x^2 \sin(\log x)}$. [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 $\boldsymbol{f(x) = \pi x - x^2}$ in a half-range sine series in the interval $(\mathbf{0}, \boldsymbol{\pi})$. [6 $Marks$]

Q. 5 Solve any THREE

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

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

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

****

	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 – 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 $x^6 - i = 0$. [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*]

-1+1

Q. 4 Solve any TWO:

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

(b) Find the Fourier series expansion for the function $f(x) = x - x^2$ in $-1 < x < 1$. [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 $\nabla \cdot \vec{F}$, where $\vec{F} = \left(\frac{x}{r}\right)\hat{\imath} + \left(\frac{y}{r}\right)\hat{\jmath} + \left(\frac{z}{r}\right)\hat{k}$. [4 *Marks*]

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

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

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

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

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

****

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 $f(x) = \frac{4}{\pi}\left(\sin x + \frac{\sin 3x}{3^2} + \frac{\sin 5x}{5^2} + \cdots \right)$	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 $\bar{F} = x^2i + xyj$ 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

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 $(D^2-4D+4)y=xe^{2x}\sin x$	Apply (CO3)	6
B)	Solve by variation of parameters $(D^2+6D+9)y=\frac{e^{-3x}}{x^3}$	Apply (CO3)	6
C)	Solve $x^2\frac{d^2y}{dx^2}-3x\frac{dy}{dx}+3y=x^2\log x$	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 $0 \le x < \pi$	Understand (CO4)	6
Q. 5	**Solve any two of the following.**		12
A)	If $\varphi = x^2y + 2xy^2 + 3yz$ then find $\nabla\varphi$ and if $\bar{F} = 2xi - yj - 2zk$ then find $\nabla \cdot \bar{F}$ and $\nabla \times \bar{F}$	Remember (CO5)	6
B)	Evaluate $\oint_C \left[(xy + y^2)dx + x^2dy \right]$ 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 $\iint_S \bar{F} \cdot ds$ where $\bar{F} = 4x\,i - 2y^2 j + z^2 k$ 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 – 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 $\boldsymbol{x^6 - i = 0}$. [4 $Marks$]

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

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

Q. 2

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

(b) Solve: $\boldsymbol{(x^2 + y^2)dx - xy\, dy = 0}$. [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 $\boldsymbol{\frac{g}{n^2} \log \cos h\, (nt)}$. [4 $Marks$]

Q. 3 Solve any THREE:

(a) Solve $\boldsymbol{(D^6 - D^4)y = x^2}$. [4 $Marks$]

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

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

(d) Solve: $\boldsymbol{x^2 \frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 5y = x^2 \sin(\log x)}$. [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 $f(x) = \pi x - x^2$ 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

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

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

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

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

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

Q. 6:

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

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

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

where C is bounded by $y = x$ and $y = x^2$. [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 $f(x) = x$ in the interval $(0, 2\pi)$. [6 $Marks$]

(b) Find the Fourier series expansion for the function $f(x) = x - x^2$ in $-1 < x < 1$. [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

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

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

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

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

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

Q. 6:

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

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

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

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

(c) Show that $\iiint_v \frac{dv}{r^2} = \iint_s \frac{\vec{r} \cdot \hat{n}}{r^2}\, ds$. [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* λ 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 $\mathrm{d}y = x^2$.

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 – 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

---

Q.1

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

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

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

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

Q.2

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

(b) Solve: $(y+logx)dx-(x)dy=0$. [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: $(D^2-2D+1)y=x\,e^x\,sinx$. [6 $Marks$]

(c) Solve by the method of variation of parameters

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

Q.4

(a) Find the Fourier series of $\boldsymbol{f(x) = x^2}$ in the interval $(\mathbf{0}\,,\ \mathbf{2\pi})$, 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 $\boldsymbol{f(x) = \pi x - x^2}$ in a half – range sine series in the interval $(\mathbf{0}, \boldsymbol{\pi})$.

[6 $Marks$]

Q.5

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

$\vec{\boldsymbol{F}}(\boldsymbol{t}) \cdot \frac{d\vec{F}(t)}{dt} = \mathbf{0}$.

[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 $\boldsymbol{\omega}$. Show that the path is equiangular spiral $\boldsymbol{\omega s = Ae^{\omega t} + B}$, where A and B are the constant.

[6 $Marks$]

Q.6

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

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

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

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

****************************Paper 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 $(\boldsymbol{i})^{\frac{1}{4}}$ $[4\ Marks]$

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

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

Q.2

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

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

(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 $\boldsymbol{V_1}$ and $\boldsymbol{V_2}$ are their maximum velocities respectively, show that $\boldsymbol{V_1 = V_2^2}$. $[4\ Marks]$

Q.3 Solve any TWO:

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

(b) Solve: $\boldsymbol{(D^6 - D^4)y = x^2}$. $[6\ Marks]$

(c) Solve by the method of variation of parameters

$\boldsymbol{\frac{d^2y}{dx^2} + y = cosecx}$. $[6\ Marks]$

Q.4

(a) Find the Fourier series of $\boldsymbol{f(x) = x^2}$ in the interval $(-\boldsymbol{\pi},\ \boldsymbol{\pi})$, 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 $\boldsymbol{f(x) = 2x - x^2}$ in $\boldsymbol{0 \le x \le 2}$, show that $\boldsymbol{f(x) = \frac{2}{3} - \sum_{n=1}^{\infty} \frac{4}{n^2\pi^2} \cos n\pi x}$.

[6 $Marks$]

Q.5

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

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

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

[6 $Marks$]

Q.6

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

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

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

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

****

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE
End – Semester Examination (Supplementary): November 2018

Branch: B. Tech (Common to all) **Semester:** II
Subject with code: Engineering Mathematics – II (MATH 201)
Date: 27/11/2018 **Max Marks:** 60 **Duration:** 03 Hrs.

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

Q.1 (a) Prove that $\boldsymbol{cos^6\theta - sin^6\theta = \frac{1}{16}(cos6\theta + 15cos2\theta)}$. [6 $Marks$]

(b) If $\boldsymbol{an(A + iB) = x + iy}$, prove that

(i) $\boldsymbol{tan2A = \frac{2x}{1-x^2-y^2}}$ (ii) $\boldsymbol{tanh2B = \frac{2y}{1+x^2+y^2}}$. [6 $Marks$]

Q.2 (a) Solve $\boldsymbol{\left(1 + e^{\frac{x}{y}}\right) dx + e^{\frac{x}{y}}\left(1 - \frac{x}{y}\right) dy = 0}$. [6 $Marks$]

(b) Solve

$\boldsymbol{x - xdy + logxdx = 0}$. [6 $Marks$]

Q.3 **Solve any TWO:**

(a) Solve $\boldsymbol{y'' + 4y' + 13y = 18e^{-2x}}$. [6 $Marks$]

(b) Solve $\boldsymbol{(D^2 + 5D + 4)y = x^2 + 7x + 9}$. [6 $Marks$]

(c) Solve by the method of variation of parameters

$\boldsymbol{\frac{d^2y}{dx^2} + y = cosecx}$. [6 $Marks$]

Q.4 (a) Find the Fourier series of $\boldsymbol{f(x) = x^2}$ in the interval $(\boldsymbol{0}\ ,\ \boldsymbol{2\pi})$ and hence deduce that

$\boldsymbol{\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots}$ [6 $Marks$]

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

[6 $Marks$]

P.T.O.

Q.5 (a) The necessary and sufficient condition for vector $\vec{F}(t)$ to have constant magnitude is

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

(b) A point moves in a plane so that its tangential and normal components of acceleration are equal and the 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 & B are constants. $[6\ Marks]$

Q.6 **Solve any TWO:**

(a) Find curl$\vec{F}$, where $\vec{F} = \nabla\left(x^3 + y^3 + z^3 - 3xyz\right)$. $[6\ Marks]$

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

$$\nabla.(r^n\vec{r}) = (n+3)r^n\,. \qquad [6\ Marks]$$

(c) Show that $\iiint_v \frac{dv}{r^2} = \iint_s \frac{\vec{r}\,.\,\hat{n}}{r^2}\,ds$. $[6\ Marks]$

****

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE
End – Semester Examination (Supplementary): November 2018

Branch: B. Tech (Common to all) **Semester:** II
Subject with code: Engineering Mathematics – II (MATH 201)
Date: 27/11/2018 **Max Marks:** 60 **Duration:** 03 Hrs.

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

Q.1 (a) Prove that $\cos^6\theta - \sin^6\theta = \frac{1}{16}(\cos 6\theta + 15\cos 2\theta)$. [6 Marks]

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

(i) $\tan 2A = \frac{2x}{1-x^2-y^2}$ (ii) $\tanh 2B = \frac{2y}{1+x^2+y^2}$. [6 Marks]

Q.2 (a) Solve $\left(1 + e^{\frac{x}{y}}\right) dx + e^{\frac{x}{y}}\left(1 - \frac{x}{y}\right) dy = 0$. [6 Marks]

(b) Solve

$x - xdy + \log x dx = 0$. [6 Marks]

Q.3 **Solve any TWO:**

(a) Solve $y'' + 4y' + 13y = 18e^{-2x}$. [6 Marks]

(b) Solve $(D^2 + 5D + 4)y = x^2 + 7x + 9$. [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]

P.T.O.

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 the 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 & B are constants. [6 *Marks*]

Q.6 **Solve any TWO:**

(a) Find curl $\vec{F}$, where $\vec{F} = \nabla \left(x^3 + y^3 + z^3 - 3xyz\right)$. [6 *Marks*]

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

$$\nabla.(r^n \vec{r}) = (n+3)r^n .$$ [6 *Marks*]

(c) Show that $\iiint_v \frac{dv}{r^2} = \iint_s \frac{\vec{r}\,.\,\hat{n}}{r^2}\, ds$. [6 *Marks*]

****

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

---

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

Q.2

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

(b) Solve: $(y+logx)dx-(x)dy=0$. [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: $(D^2-2D+1)y=x\,e^x\,sinx$. [6 *Marks*]

(c) Solve by the method of variation of parameters

$\frac{d^2y}{dx^2}+y=cosecx$. [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

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

Seat No.	

Set **P**

F.E. (Part – II) (CGPA) (Old) Examination, 2018
ENGINEERING MATHEMATICS – II

Day and Date : Monday, 19-11-2018 Max. Marks : 70
Time : 10.00 a.m. to 1.00 p.m.

Instructions : *1) Q. No. **1** is **compulsory**. It should be solved in **first 30 minutes** in Answer Book Page No. **3**. **Each** question carries **one** mark.*
*2) **Answer MCQ/Objective type questions on Page No. 3 only. Don't forget to mention, Q.P. Set (P/Q/R/S) on Top of Page.***
*3) **Use** of non-programmable calculator is **allowed**.*
*4) Figures to the **right** indicate **full** marks.*

MCQ/Objective Type Questions

Duration : 30 Minutes Marks : 14

1. Choose the correct alternative : **(14×1=14)**

1) Among the following which method is best for solving initial value problem ?
   a) Euler's method b) Picard's method
   c) Taylor's series method d) R-K method of order 4

2) If $\frac{dy}{dx} = x + y$ with y(0) = 1 and h = 0.2 then by Eulers method the approximate value of y(0.2) is equals to
   a) 1 b) 1.2 c) 1.4 d) – 1.2

3) In the Newton's forward difference formula $\left[\frac{d^2y}{dx^2}\right]_{x=x_0} = \frac{1}{h^2}\left[\Delta^2 y_0 - \Delta^3 y_0 + k...\right]$ the value of K is
   a) $\frac{12}{11}\Delta^4 y_0$ b) $\frac{-11}{12}\Delta^4 y_0$ c) $-\Delta^4 y_0$ d) $\frac{11}{12}\Delta^4 y_0$

4) To find the value of the derivatives numerically at the beginning or near to the beginning value of argument x, we use
   a) Newton's forward difference formula b) Newton's backward difference formula
   c) Central difference formula d) Divided difference formula

5) If K is a constant, the curve whose subnormal is equal to the abscissa is
   a) $y^2 - x^2 = K$ b) $x^2 + y^2 = K$ c) $y - x = K$ d) $x + y = K$

P.T.O.

6) The differential equation $\frac{dy}{dx} = \frac{a_1x + b_1y + c_1}{a_2x + b_2y + c_2}$ will be exact if

a) $b_2 = -a_1$ b) $a_2 = -b_1$ c) $b_1 = a_2$ d) $a_1 = b_2$

7) The integrating factor of the D.E. $\frac{dy}{dx} + \frac{2xy}{1+x^2} = 0$ is

a) e^{-x} b) x c) $1 + x^2$ d) $\frac{1}{1+x^2}$

8) The beta function B(m, n) converges for

a) $m \geq -1, n \geq -1$ b) $m > 0, n \geq -2$ c) $m \geq -1, n > 1$ d) $m > 0, n > 0$

9) If $I(a) = \int_0^1 \frac{x^a - 1}{\log x} dx$ then $\frac{dI}{da} =$

a) $\frac{1}{a-1}$ b) $\frac{1}{a+1}$ c) $\frac{-1}{a+1}$ d) $\frac{1}{\log a}$

10) The curve $x^3 + y^3 = 3xy$ is symmetrical about

a) The line y = x b) x – axis c) y – axis d) both axes

11) The length of the curve $r = f(\theta)$ from $\theta = \theta_1$ to $\theta = \theta_2$ is given by

a) $\int_{\theta_1}^{\theta_2} \left[r^2 + \left(\frac{dr}{d\theta}\right)\right]^2$ b) $\int_{\theta_1}^{\theta_2} \sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2} . dr$

c) $\int_{\theta_1}^{\theta_2} \sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2} . d\theta$ d) None of these

12) The value of $\int_0^\infty \int_0^\infty \frac{dx\,dy}{(1+x^2)(1+y^2)}$ is

a) $\frac{\pi^2}{2}$ b) $\frac{\pi^2}{4}$ c) $\frac{\pi}{2}$ d) $\frac{\pi}{4}$

13) For $\int_0^a \int_0^x f(x, y)\,dy\,dx$ the change of order is

a) $\int_0^a \int_y^a f(x,y)\,dx\,dy$ b) $\int_0^a \int_0^y f(x, y)\,dx\,dy$ c) $\int_0^x \int_0^a f(x,y)\,dx\,dy$ d) None of these

14) If the density at any point varies as the distance of the point from the x-axis, then ρ is equal to

a) Kx b) Kxy c) Ky d) $K(x^2 + y^2)$

Set P

Seat No.	

F.E. (Part – II) (CGPA) (Old) Examination, 2018
ENGINEERING MATHEMATICS – II

Day and Date : Monday, 19-11-2018 Marks : 56
Time : 10.00 a.m. to 1.00 p.m.

Instructions : *1) Attempt **any three** questions from **each** Section.*
*2) **Use** of non-programmable calculator is **allowed**.*
*3) Figures to the **right** indicate **full** marks.*

SECTION – I

2. a) Solve $\frac{dy}{dx} = \frac{6x-2y-7}{3x-y+4}$. **3**

b) Solve $(\sin x \cos y + e^{2x})dx + (\cos x \sin y + \tan y)dy = 0$. **3**

c) Solve $(1 + x^2)dy = (e^{\tan^{-1}x} - y)dx$. **4**

OR

c) Solve $xy - \frac{dy}{dx} = y^3 e^{-x^2}$

3. Attempt the following :

a) Find orthogonal trajectories of the family of curves $x^p + cy^p = 1$ where c is parameter and p is constant. **3**

b) Show that all curves for which the square of the normal is equal to the square of the radius vector are either circles or rectangular hyperbolas. **3**

c) Water at temperature 100°C cools in 10 minutes to 88°C in a room of temperature 25°C. Find the temperature of water after 20 minutes. **3**

4. a) From the following data find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 1.1 and x = 2.1. **5**

x :	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y :	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

b) From the following table find $\frac{dy}{dx}$ at x = 1. **4**

x :	– 1	1	2	3
y :	– 21	15	12	3

Set P

5. Attempt the following :

   a) Find approximate value of y when x = 0.1, if $\frac{dy}{dx} = x - y^2$ and y = 1 at x = 0, using Taylor's method. **3**

   b) Solve $\frac{dy}{dx} = 2 + \sqrt{xy}$ with y(1.2) = 1.6403 by Euler's modified method for x = 1.4, taking h = 0.2. **3**

   c) Using Runge-Kutta method of fourth order find y(0.1), given that $\frac{dy}{dx} = xy + y^2$ with y(0) = 1 in one step. **3**

SECTION – II

6. a) Evaluate $\int_0^\infty x^{n-1} e^{-h^2x^2} dx$. **3**

   b) Evaluate $\int_0^2 x^7 (16 - x^4)^{10}\, dx$. **3**

   c) Evaluate $\int_0^\infty \frac{e^{-x}}{x}\left(1 - e^{-ax}\right) dx$. **3**

7. a) Trace the curve $y^2 (4 - x) = x(x - 2)^2$ with justification. **3**

   b) Trace the curve x = a (t + sint), y = a (1 + cost) with justification. **3**

   c) Find the perimeter of the Cardioid r = a (1 + cosθ). **3**

8. a) Evaluate $\int_0^2 \int_1^z \int_0^{yz} xyz\, dx\, dy\, dz$. **3**

   b) Evaluate $\int_0^1 \int_0^{\sqrt{1+x^2}} \frac{dx\, dy}{1 + x^2 + y^2}$. **3**

   c) Change the order of integration and evaluate $\int_0^1 \int_{\sqrt{x}}^1 e^{x/y}\, dx\, dy$. **4**

   OR

   c) Change to polar co-ordinate and evaluate $\int_0^{a/\sqrt{2}} \int_y^{\sqrt{a^2-y^2}} \log(x^2 + y^2)\, dx dy$.

9. a) Find the volume generated by revolving the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ about the x-axis. **3**

   b) Find the mass distributed over the area bounded by the curve $16y^2 = x^3$ and the line 2y = x, if the density at any point varies as the distance of the point from x-axis. **3**

   c) Find the area between the circles r = 2 sinθ and r = 4 sinθ. **3**

———————

Set P

SLR-TX – 17

Seat No.	

Set **Q**

F.E. (Part – II) (CGPA) (Old) Examination, 2018
ENGINEERING MATHEMATICS – II

Day and Date : Monday, 19-11-2018 Max. Marks : 70
Time : 10.00 a.m. to 1.00 p.m.

Instructions : *1) Q. No.* ***1*** *is* ***compulsory****. It should be solved in* ***first 30 minutes*** *in Answer Book Page No.* ***3****.* ***Each*** *question carries* ***one*** *mark.*
2) ***Answer MCQ/Objective type questions on Page No. 3 only. Don't forget to mention, Q.P. Set (P/Q/R/S) on Top of Page.***
3) ***Use*** *of non-programmable calculator is* ***allowed****.*
4) Figures to the ***right*** *indicate* ***full*** *marks.*

MCQ/Objective Type Questions

Duration : 30 Minutes Marks : 14

1. Choose the correct alternative : **(14×1=14)**

1) The beta function B(m, n) converges for
a) $m \geq -1, n \geq -1$ b) $m > 0, n \geq -2$ c) $m \geq -1, n > 1$ d) $m > 0, n > 0$

2) If $I(a) = \int_0^1 \frac{x^a - 1}{\log x} dx$ then $\frac{dI}{da} =$
a) $\frac{1}{a-1}$ b) $\frac{1}{a+1}$ c) $\frac{-1}{a+1}$ d) $\frac{1}{\log a}$

3) The curve $x^3 + y^3 = 3xy$ is symmetrical about
a) The line y = x b) x – axis c) y – axis d) both axes

4) The length of the curve $r = f(\theta)$ from $\theta = \theta_1$ to $\theta = \theta_2$ is given by
a) $\int_{\theta_1}^{\theta_2} \left[r^2 + \left(\frac{dr}{d\theta}\right)\right]^2$
b) $\int_{\theta_1}^{\theta_2} \sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2}.dr$
c) $\int_{\theta_1}^{\theta_2} \sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2}.\,d\theta$
d) None of these

5) The value of $\int_0^\infty \int_0^\infty \frac{dx\,dy}{(1+x^2)(1+y^2)}$ is
a) $\frac{\pi^2}{2}$ b) $\frac{\pi^2}{4}$ c) $\frac{\pi}{2}$ d) $\frac{\pi}{4}$

P.T.O.

6) For $\int_0^a \int_0^x f(x, y)\,dy\,dx$ the change of order is

a) $\int_0^a \int_y^a f(x,y)\,dx\,dy$ b) $\int_0^a \int_0^y f(x, y)\,dx\,dy$ c) $\int_0^x \int_0^a f(x,y)\,dx\,dy$ d) None of these

7) If the density at any point varies as the distance of the point from the x-axis, then ρ is equal to

a) Kx b) Kxy c) Ky d) $K(x^2 + y^2)$

8) Among the following which method is best for solving initial value problem ?

a) Euler's method b) Picard's method

c) Taylor's series method d) R-K method of order 4

9) If $\frac{dy}{dx} = x + y$ with y(0) = 1 and h = 0.2 then by Eulers method the approximate value of y(0.2) is equals to

a) 1 b) 1.2 c) 1.4 d) – 1.2

10) In the Newton's forward difference formula $\left[\frac{d^2y}{dx^2}\right]_{x=x_0} = \frac{1}{h^2}\left[\Delta^2 y_0 - \Delta^3 y_0 + k...\right]$ the value of K is

a) $\frac{12}{11}\Delta^4 y_0$ b) $\frac{-11}{12}\Delta^4 y_0$ c) $-\Delta^4 y_0$ d) $\frac{11}{12}\Delta^4 y_0$

11) To find the value of the derivatives numerically at the beginning or near to the beginning value of argument x, we use

a) Newton's forward difference formula b) Newton's backward difference formula

c) Central difference formula d) Divided difference formula

12) If K is a constant, the curve whose subnormal is equal to the abscissa is

a) $y^2 - x^2 = K$ b) $x^2 + y^2 = K$ c) y – x = K d) x + y = K

13) The differential equation $\frac{dy}{dx} = \frac{a_1x + b_1y + c_1}{a_2x + b_2y + c_2}$ will be exact if

a) $b_2 = -a_1$ b) $a_2 = -b_1$ c) $b_1 = a_2$ d) $a_1 = b_2$

14) The integrating factor of the D.E. $\frac{dy}{dx} + \frac{2xy}{1+x^2} = 0$ is

a) e^{-x} b) x c) $1 + x^2$ d) $\frac{1}{1+x^2}$

Seat No.	

F.E. (Part – II) (CGPA) (Old) Examination, 2018
ENGINEERING MATHEMATICS – II

Day and Date : Monday, 19-11-2018 Marks : 56
Time : 10.00 a.m. to 1.00 p.m.

Instructions : *1) Attempt **any three** questions from **each** Section.*
*2) **Use** of non-programmable calculator is **allowed**.*
*3) Figures to the **right** indicate **full** marks.*

SECTION – I

2. a) Solve $\frac{dy}{dx} = \frac{6x-2y-7}{3x-y+4}$. **3**

b) Solve $(\sin x \cos y + e^{2x})dx + (\cos x \sin y + \tan y)dy = 0$. **3**

c) Solve $(1 + x^2)dy = (e^{\tan^{-1}x} - y)dx$. **4**

OR

c) Solve $xy - \frac{dy}{dx} = y^3 e^{-x^2}$

3. Attempt the following :

a) Find orthogonal trajectories of the family of curves $x^p + cy^p = 1$ where c is parameter and p is constant. **3**

b) Show that all curves for which the square of the normal is equal to the square of the radius vector are either circles or rectangular hyperbolas. **3**

c) Water at temperature 100°C cools in 10 minutes to 88°C in a room of temperature 25°C. Find the temperature of water after 20 minutes. **3**

4. a) From the following data find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 1.1 and x = 2.1. **5**

x :	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y :	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

b) From the following table find $\frac{dy}{dx}$ at x = 1. **4**

x :	– 1	1	2	3
y :	– 21	15	12	3

Set Q

5. Attempt the following :

a) Find approximate value of y when x = 0.1, if $\frac{dy}{dx} = x - y^2$ and y = 1 at x = 0, using Taylor's method. **3**

b) Solve $\frac{dy}{dx} = 2 + \sqrt{xy}$ with $y(1.2) = 1.6403$ by Euler's modified method for $x = 1.4$, taking h = 0.2. **3**

c) Using Runge-Kutta method of fourth order find y(0.1), given that $\frac{dy}{dx} = xy + y^2$ with y(0) = 1 in one step. **3**

SECTION – II

6. a) Evaluate $\int_0^\infty x^{n-1} e^{-h^2x^2} dx$. **3**

b) Evaluate $\int_0^2 x^7 (16 - x^4)^{10} dx$. **3**

c) Evaluate $\int_0^\infty \frac{e^{-x}}{x}\left(1 - e^{-ax}\right) dx$. **3**

7. a) Trace the curve $y^2 (4 - x) = x(x - 2)^2$ with justification. **3**

b) Trace the curve x = a (t + sint), y = a (1 + cost) with justification. **3**

c) Find the perimeter of the Cardioid r = a (1 + cosθ). **3**

8. a) Evaluate $\int_0^2 \int_1^z \int_0^{yz} xyz \, dx\, dy\, dz$. **3**

b) Evaluate $\int_0^1 \int_0^{\sqrt{1+x^2}} \frac{dx\,dy}{1 + x^2 + y^2}$. **3**

c) Change the order of integration and evaluate $\int_0^1 \int_{\sqrt{x}}^1 e^{x/y} dx\, dy$. **4**

OR

c) Change to polar co-ordinate and evaluate $\int_0^{a/\sqrt{2}} \int_y^{\sqrt{a^2 - y^2}} \log(x^2 + y^2)\, dx dy$.

9. a) Find the volume generated by revolving the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ about the x-axis. **3**

b) Find the mass distributed over the area bounded by the curve $16y^2 = x^3$ and the line 2y = x, if the density at any point varies as the distance of the point from x-axis. **3**

c) Find the area between the circles r = 2 sinθ and r = 4 sinθ. **3**

Set Q

Seat No.	

Set **R**

F.E. (Part – II) (CGPA) (Old) Examination, 2018
ENGINEERING MATHEMATICS – II

Day and Date : Monday, 19-11-2018 Max. Marks : 70

Time : 10.00 a.m. to 1.00 p.m.

Instructions : *1) Q. No. **1** is **compulsory**. It should be solved in **first 30 minutes** in Answer Book Page No. **3**. **Each** question carries **one** mark.*

*2) **Answer MCQ/Objective type questions on Page No. 3 only. Don't forget to mention, Q.P. Set (P/Q/R/S) on Top of Page.***

*3) **Use** of non-programmable calculator is **allowed**.*

*4) Figures to the **right** indicate **full** marks.*

MCQ/Objective Type Questions

Duration : 30 Minutes Marks : 14

1. Choose the correct alternative : **(14×1=14)**

1) If K is a constant, the curve whose subnormal is equal to the abscissa is

a) $y^2 - x^2 = K$ b) $x^2 + y^2 = K$ c) $y - x = K$ d) $x + y = K$

2) The differential equation $\frac{dy}{dx} = \frac{a_1x + b_1y + c_1}{a_2x + b_2y + c_2}$ will be exact if

a) $b_2 = - a_1$ b) $a_2 = - b_1$ c) $b_1 = a_2$ d) $a_1 = b_2$

3) The integrating factor of the D.E. $\frac{dy}{dx} + \frac{2xy}{1+x^2} = 0$ is

a) e^{-x} b) x c) $1 + x^2$ d) $\frac{1}{1+x^2}$

4) The beta function B(m, n) converges for

a) $m \geq - 1, n \geq - 1$ b) $m > 0, n \geq - 2$ c) $m \geq -1, n > 1$ d) $m > 0, n > 0$

5) If $I(a) = \int_0^1 \frac{x^a - 1}{\log x} dx$ then $\frac{dI}{da} =$

a) $\frac{1}{a-1}$ b) $\frac{1}{a+1}$ c) $\frac{-1}{a+1}$ d) $\frac{1}{\log a}$

6) The curve $x^3 + y^3 = 3xy$ is symmetrical about

a) The line y = x b) x – axis c) y – axis d) both axes

P.T.O.

7) The length of the curve $r = f(\theta)$ from $\theta = \theta_1$ to $\theta = \theta_2$ is given by

a) $\int_{\theta_1}^{\theta_2} \left[r^2 + \left(\frac{dr}{d\theta}\right)\right]^2$

b) $\int_{\theta_1}^{\theta_2} \sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2}\,.dr$

c) $\int_{\theta_1}^{\theta_2} \sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2}\,.\,d\theta$

d) None of these

8) The value of $\int_0^{\infty}\int_0^{\infty} \frac{dx\,dy}{(1+x^2)(1+y^2)}$ is

a) $\frac{\pi^2}{2}$ b) $\frac{\pi^2}{4}$ c) $\frac{\pi}{2}$ d) $\frac{\pi}{4}$

9) For $\int_0^{a}\int_0^{x} f(x, y)\,dy\,dx$ the change of order is

a) $\int_0^{a}\int_y^{a} f(x,y)\,dx\,dy$ b) $\int_0^{a}\int_0^{y} f(x, y)dx\,dy$ c) $\int_0^{x}\int_0^{a} f(x,y)dx\,dy$ d) None of these

10) If the density at any point varies as the distance of the point from the x-axis, then ρ is equal to

a) Kx b) Kxy c) Ky d) $K(x^2 + y^2)$

11) Among the following which method is best for solving initial value problem ?

a) Euler's method b) Picard's method

c) Taylor's series method d) R-K method of order 4

12) If $\frac{dy}{dx} = x + y$ with $y(0) = 1$ and $h = 0.2$ then by Eulers method the approximate value of $y(0.2)$ is equals to

a) 1 b) 1.2 c) 1.4 d) – 1.2

13) In the Newton's forward difference formula $\left[\frac{d^2y}{dx^2}\right]_{x=x_0} = \frac{1}{h^2}\left[\Delta^2 y_0 - \Delta^3 y_0 + k...\right]$ the value of K is

a) $\frac{12}{11}\Delta^4 y_0$ b) $\frac{-11}{12}\Delta^4 y_0$ c) $-\Delta^4 y_0$ d) $\frac{11}{12}\Delta^4 y_0$

14) To find the value of the derivatives numerically at the beginning or near to the beginning value of argument x, we use

a) Newton's forward difference formula b) Newton's backward difference formula

c) Central difference formula d) Divided difference formula

Set R

Seat No.	

F.E. (Part – II) (CGPA) (Old) Examination, 2018
ENGINEERING MATHEMATICS – II

Day and Date : Monday, 19-11-2018 Marks : 56
Time : 10.00 a.m. to 1.00 p.m.

Instructions : *1) Attempt **any three** questions from **each** Section.*
*2) **Use** of non-programmable calculator is **allowed**.*
*3) Figures to the **right** indicate **full** marks.*

SECTION – I

2. a) Solve $\frac{dy}{dx} = \frac{6x-2y-7}{3x-y+4}$. **3**

b) Solve $(\sin x \cos y + e^{2x})dx + (\cos x \sin y + \tan y)dy = 0$. **3**

c) Solve $(1 + x^2)dy = (e^{\tan^{-1}x} - y)dx$. **4**

OR

c) Solve $xy - \frac{dy}{dx} = y^3 e^{-x^2}$

3. Attempt the following :

a) Find orthogonal trajectories of the family of curves $x^p + cy^p = 1$ where c is parameter and p is constant. **3**

b) Show that all curves for which the square of the normal is equal to the square of the radius vector are either circles or rectangular hyperbolas. **3**

c) Water at temperature 100°C cools in 10 minutes to 88°C in a room of temperature 25°C. Find the temperature of water after 20 minutes. **3**

4. a) From the following data find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 1.1 and x = 2.1. **5**

x :	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y :	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

b) From the following table find $\frac{dy}{dx}$ at x = 1. **4**

x :	– 1	1	2	3
y :	– 21	15	12	3

5. Attempt the following :

   a) Find approximate value of y when x = 0.1, if $\frac{dy}{dx} = x - y^2$ and y = 1 at x = 0, using Taylor's method. **3**

   b) Solve $\frac{dy}{dx} = 2 + \sqrt{xy}$ with $y(1.2) = 1.6403$ by Euler's modified method for $x = 1.4$, taking h = 0.2. **3**

   c) Using Runge-Kutta method of fourth order find y(0.1), given that $\frac{dy}{dx} = xy + y^2$ with y(0) = 1 in one step. **3**

SECTION – II

6. a) Evaluate $\int_0^\infty x^{n-1} e^{-h^2x^2} dx$. **3**

   b) Evaluate $\int_0^2 x^7 (16 - x^4)^{10} dx$. **3**

   c) Evaluate $\int_0^\infty \frac{e^{-x}}{x}\left(1 - e^{-ax}\right) dx$. **3**

7. a) Trace the curve $y^2 (4 - x) = x(x - 2)^2$ with justification. **3**

   b) Trace the curve x = a (t + sint), y = a (1 + cost) with justification. **3**

   c) Find the perimeter of the Cardioid r = a (1 + cosθ). **3**

8. a) Evaluate $\int_0^2 \int_1^z \int_0^{yz} xyz \, dx \, dy \, dz$. **3**

   b) Evaluate $\int_0^1 \int_0^{\sqrt{1+x^2}} \frac{dx\,dy}{1 + x^2 + y^2}$. **3**

   c) Change the order of integration and evaluate $\int_0^1 \int_{\sqrt{x}}^1 e^{x/y} \, dx \, dy$. **4**

   OR

   c) Change to polar co-ordinate and evaluate $\int_0^{a/\sqrt{2}} \int_y^{\sqrt{a^2 - y^2}} \log(x^2 + y^2) \, dx dy$.

9. a) Find the volume generated by revolving the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ about the x-axis. **3**

   b) Find the mass distributed over the area bounded by the curve $16y^2 = x^3$ and the line 2y = x, if the density at any point varies as the distance of the point from x-axis. **3**

   c) Find the area between the circles r = 2 sinθ and r = 4 sinθ. **3**

Set R

Seat No.	

Set **S**

F.E. (Part – II) (CGPA) (Old) Examination, 2018
ENGINEERING MATHEMATICS – II

Day and Date : Monday, 19-11-2018 Max. Marks : 70
Time : 10.00 a.m. to 1.00 p.m.

Instructions : *1) Q. No. **1** is **compulsory**. It should be solved in **first 30 minutes** in Answer Book Page No. **3**. **Each** question carries **one** mark.*
*2) **Answer MCQ/Objective type questions on Page No. 3 only. Don't forget to mention, Q.P. Set (P/Q/R/S) on Top of Page.***
*3) **Use** of non-programmable calculator is **allowed**.*
*4) Figures to the **right** indicate **full** marks.*

MCQ/Objective Type Questions

Duration : 30 Minutes Marks : 14

1. Choose the correct alternative : **(14×1=14)**

1) The curve $x^3 + y^3 = 3xy$ is symmetrical about
a) The line y = x b) x – axis c) y – axis d) both axes

2) The length of the curve $r = f(\theta)$ from $\theta = \theta_1$ to $\theta = \theta_2$ is given by
a) $\int_{\theta_1}^{\theta_2}\left[r^2 + \left(\frac{dr}{d\theta}\right)\right]^2$ b) $\int_{\theta_1}^{\theta_2}\sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2}\,.dr$
c) $\int_{\theta_1}^{\theta_2}\sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2}\,.\,d\theta$ d) None of these

3) The value of $\int_0^\infty\int_0^\infty \frac{dx\,dy}{(1+x^2)(1+y^2)}$ is
a) $\frac{\pi^2}{2}$ b) $\frac{\pi^2}{4}$ c) $\frac{\pi}{2}$ d) $\frac{\pi}{4}$

4) For $\int_0^a\int_0^x f(x, y)\,dy\,dx$ the change of order is
a) $\int_0^a\int_y^a f(x,y)\,dx\,dy$ b) $\int_0^a\int_0^y f(x, y)dx\,dy$ c) $\int_0^x\int_0^a f(x,y)dx\,dy$ d) None of these

P.T.O.

5) If the density at any point varies as the distance of the point from the x-axis, then ρ is equal to

a) Kx b) Kxy c) Ky d) $K(x^2 + y^2)$

6) Among the following which method is best for solving initial value problem ?

a) Euler's method b) Picard's method
c) Taylor's series method d) R-K method of order 4

7) If $\frac{dy}{dx} = x + y$ with y(0) = 1 and h = 0.2 then by Eulers method the approximate value of y(0.2) is equals to

a) 1 b) 1.2 c) 1.4 d) – 1.2

8) In the Newton's forward difference formula $\left[\frac{d^2y}{dx^2}\right]_{x=x_0} = \frac{1}{h^2}\left[\Delta^2 y_0 - \Delta^3 y_0 + k...\right]$ the value of K is

a) $\frac{12}{11}\Delta^4 y_0$ b) $\frac{-11}{12}\Delta^4 y_0$ c) $-\Delta^4 y_0$ d) $\frac{11}{12}\Delta^4 y_0$

9) To find the value of the derivatives numerically at the beginning or near to the beginning value of argument x, we use

a) Newton's forward difference formula b) Newton's backward difference formula
c) Central difference formula d) Divided difference formula

10) If K is a constant, the curve whose subnormal is equal to the abscissa is

a) $y^2 - x^2 = K$ b) $x^2 + y^2 = K$ c) $y - x = K$ d) $x + y = K$

11) The differential equation $\frac{dy}{dx} = \frac{a_1x + b_1y + c_1}{a_2x + b_2y + c_2}$ will be exact if

a) $b_2 = -a_1$ b) $a_2 = -b_1$ c) $b_1 = a_2$ d) $a_1 = b_2$

12) The integrating factor of the D.E. $\frac{dy}{dx} + \frac{2xy}{1+x^2} = 0$ is

a) e^{-x} b) x c) $1 + x^2$ d) $\frac{1}{1+x^2}$

13) The beta function B(m, n) converges for

a) $m \geq -1, n \geq -1$ b) $m > 0, n \geq -2$ c) $m \geq -1, n > 1$ d) $m > 0, n > 0$

14) If $I(a) = \int_0^1 \frac{x^a - 1}{\log x} dx$ then $\frac{dI}{da} =$

a) $\frac{1}{a-1}$ b) $\frac{1}{a+1}$ c) $\frac{-1}{a+1}$ d) $\frac{1}{\log a}$

SLR-TX – 17

Seat No.	

F.E. (Part – II) (CGPA) (Old) Examination, 2018
ENGINEERING MATHEMATICS – II

Day and Date : Monday, 19-11-2018 Marks : 56
Time : 10.00 a.m. to 1.00 p.m.

Instructions : *1) Attempt **any three** questions from **each** Section.*
*2) **Use** of non-programmable calculator is **allowed**.*
*3) Figures to the **right** indicate **full** marks.*

SECTION – I

2\. a) Solve $\frac{dy}{dx} = \frac{6x - 2y - 7}{3x - y + 4}$. **3**

b) Solve $(\sin x \cos y + e^{2x})dx + (\cos x \sin y + \tan y)dy = 0$. **3**

c) Solve $(1 + x^2)dy = (e^{\tan^{-1}x} - y)dx$. **4**

OR

c) Solve $xy - \frac{dy}{dx} = y^3 e^{-x^2}$

3\. Attempt the following :

a) Find orthogonal trajectories of the family of curves $x^p + cy^p = 1$ where c is parameter and p is constant. **3**

b) Show that all curves for which the square of the normal is equal to the square of the radius vector are either circles or rectangular hyperbolas. **3**

c) Water at temperature 100°C cools in 10 minutes to 88°C in a room of temperature 25°C. Find the temperature of water after 20 minutes. **3**

4\. a) From the following data find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 1.1 and x = 2.1. **5**

x :	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y :	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

b) From the following table find $\frac{dy}{dx}$ at x = 1. **4**

x :	– 1	1	2	3
y :	– 21	15	12	3

Set S

5. Attempt the following :

a) Find approximate value of y when x = 0.1, if $\frac{dy}{dx} = x - y^2$ and y = 1 at x = 0, using Taylor's method. **3**

b) Solve $\frac{dy}{dx} = 2 + \sqrt{xy}$ with y(1.2) = 1.6403 by Euler's modified method for x = 1.4, taking h = 0.2. **3**

c) Using Runge-Kutta method of fourth order find y(0.1), given that $\frac{dy}{dx} = xy + y^2$ with y(0) = 1 in one step. **3**

SECTION – II

6. a) Evaluate $\int_0^\infty x^{n-1} e^{-h^2x^2} dx$. **3**

b) Evaluate $\int_0^2 x^7 (16 - x^4)^{10} dx$. **3**

c) Evaluate $\int_0^\infty \frac{e^{-x}}{x}\left(1 - e^{-ax}\right) dx$. **3**

7. a) Trace the curve $y^2 (4 - x) = x(x - 2)^2$ with justification. **3**

b) Trace the curve x = a (t + sint), y = a (1 + cost) with justification. **3**

c) Find the perimeter of the Cardioid r = a (1 + cosθ). **3**

8. a) Evaluate $\int_0^2 \int_1^z \int_0^{yz} xyz \, dx\, dy\, dz$. **3**

b) Evaluate $\int_0^1 \int_0^{\sqrt{1+x^2}} \frac{dx\,dy}{1 + x^2 + y^2}$. **3**

c) Change the order of integration and evaluate $\int_0^1 \int_{\sqrt{x}}^1 e^{x/y} dx\,dy$. **4**

OR

c) Change to polar co-ordinate and evaluate $\int_0^{a/\sqrt{2}} \int_y^{\sqrt{a^2-y^2}} \log(x^2 + y^2)\, dxdy$.

9. a) Find the volume generated by revolving the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ about the x-axis. **3**

b) Find the mass distributed over the area bounded by the curve $16y^2 = x^3$ and the line 2y = x, if the density at any point varies as the distance of the point from x-axis. **3**

c) Find the area between the circles r = 2 sinθ and r = 4 sinθ. **3**

Set S