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 $(\boldsymbol{i})^{\frac{1}{4}}$. [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 $\log(1+e^{2i\theta}) = \log(2cos\theta) + i\theta$. [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 $\boldsymbol{f(x) = x^2}$ 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 $\vec{\boldsymbol{F}} = \nabla\,(\boldsymbol{x^3 + y^3 + z^3 - 3xyz})$. [4 $Marks$]

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

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

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

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