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 $f(x) = x^2$ 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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