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Roll No. .....

Code No. : 2041(A)

[Total No. of Pages : 8

Sl. No.

ODD SEMESTER EXAMINATION, DECEMBER - 2019

[First Semester] Three Years Diploma Course in Civil Engineering [322]
[First Semester] Three Years Diploma Course in Civil Engineering (Environmental Pollution & Control) [323]
[First Semester] Three Years Diploma Course in Electrical Engineering [328]
[First Semester] Three Years Diploma Course in Electrical Engineering (Industrial Control) [329]
[First Semester] Three Years Diploma Course in Electronics Engineering [330]
[First Semester] Three Years Diploma Course in Electronics Engg. (Moderncomsumer Electronics Appliances) [331]
[First Semester] Three Years Diploma Course in Electronics Engg. (Advance Microprocessor & Interface) [332]
[First Semester] Three Years Diploma Course in Electronics Engineering (Micro Electronics) [333]
[First Semester] Three Years Diploma Course in Instrumentation & Control Engg. [338]
[First Semester] Three Years Diploma Course in Mechanical Engineering (Automobile) [341]
[First Semester] Three Years Diploma Course in Mechanical Engineering (Computer Aided Design) [342]
[First Semester] Three Years Diploma Course in Mechanical Engineering (Production) [343]
[First Semester] Three Years Diploma Course in Mechanical Engineering (R A C) [344]
[First Semester] Three Years Diploma Course in Mechanical Engineering (Maintenance) [345]
[First Semester] Three Years Diploma Course in Chemical Engineering [352]
[First Semester] Three Years Diploma Course in Computer Science And Engineering [355]
[First Semester] Three Years Diploma Course in Information Technology [356]
[First Semester] Three Years Diploma Course in Mechanical Engineering [367]
[Third Semester] Three Years Diploma Course in Civil Engineering {Lateral Entry} [375]
[Third Semester] Three Years Diploma Course in Civil Engineering (Environmental Pollution & Control) {Lateral Entry} [376]

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[Third Semester] Three Years Diploma Course in Electrical Engineering {Lateral Entry} [378]

[Third Semester] Three Years Diploma Course in Electrical Engineering (Industrial Control) {Lateral Entry} [379]

[Third Semester] Three Years Diploma Course in Electronics Engineering {Lateral Entry} [380]

[Third Semester] Three Years Diploma Course in Electronics Engg. (Modernconsumer Electronics Appliances) {Lateral Entry} [381]

[Third Semester] Three Years Diploma Course in Electronics Engg. (Advancemicroprocessor & Interface) {Lateral Entry} [382]

[Third Semester] Three Years Diploma Course in Electronics Engineering (Micro Electronics){Lateral Entry} [383]

[Third Semester] Three Years Diploma Course in Mechanical Engineering (Automobile) {Lateral Entry} [384]

[Third Semester] Three Years Diploma Course in Mechanical Engineering (Computer Aided Design) {Lateral Entry} [385]

[Third Semester] Three Years Diploma Course in Mechanical Engineering (Production) {Lateral Entry} [386]

[Third Semester] Three Years Diploma Course in Mechanical Engineering (RA C) {Lateral Entry} [387]

[Third Semester] Three Years Diploma Course in Mechanical Engineering (Maintenance) {Lateral Entry} [388]

[Third Semester] Three Years Diploma Course in Computer Science And Engineering {Lateral Entry} [389]

[Third Semester] Three Years Diploma Course in Information Technology {Lateral Entry} [390]

APPLIED MATHEMATICS - I

Time : 2.30 Hours] **[Maximum Marks : 50**
[Minimum Marks : 17

NOTES :

i) Attempt **all** questions.

ii) Students are advised to specially check the Numerical Data of question paper in both versions. If there is any difference in Hindi Translation of any question, the students should answer the question according to the English version.

iii) Use of Pager and Mobile Phone by the students is not allowed.

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Q1) Answer any ten parts of the following, from parts a to e select correct choice. **[10 × 1 = 10]**

a) If $2\sin\theta = 1$ the value of angle θ is

i) $\frac{\pi}{4}$ ii) $\frac{\pi}{6}$

iii) $\frac{\pi}{2}$ iv) none

b) If $f(x)=\frac{1-x^2}{1+x^2}$ then the value of $f(\tan\theta)$ is

i) $\sin 2\theta$ ii) $\tan 2\theta$

iii) $\cos 2\theta$ iv) none

c) Angle between the vectors $\hat{i}-2\hat{j}+\hat{k}$ and $4\hat{i}-3\hat{j}-4\hat{k}$ is

i) $90°$ ii) $\cos^{-1}\left\{\sqrt{\frac{6}{41}}\right\}$

iii) $45°$ iv) $\sin^{-1}\left(\frac{3}{5}\right)$

d) Which term of the series $\frac{1}{4}-\frac{1}{2}+1-$..... is -128?

i) 20th ii) 10th

iii) 15th iv) 25th

e) $\frac{d}{dx}\left(\frac{2x^2}{x+7}\right)$ is

i) $\frac{3x}{x+7}$ ii) $2x^2(x+7)$

iii) $\frac{4x}{7}$ iv) none

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f) Evaluate $\lim_{x \to 2} \frac{x^2 + x - 6}{x^2 - 4}$

g) Evaluate $(1 + 2i)(2 - i)$

h) In Δ ABC prove that $\frac{\sin A - \sin B}{\sin A + \sin B} = \frac{a - b}{a + b}$

i) Evaluate $\begin{vmatrix} 2 & 3 & 1 \\ 1 & 11 & -2 \\ 3 & 1 & 4 \end{vmatrix}$

j) Write the expansion of $(x + a)^n$ where n is a positive integral index.

k) If $y = 7x^5 - 5x^4 - 3x^2 + 5x + 7$, find $\frac{d^3y}{dx^3}$.

l) Evaluate $(\cos\theta + i\sin\theta)^7 \times (\cos\theta - i\sin\theta)^3$.

Q2) Answer any five parts of the following : **[5 × 2 = 10]**

a) Find the sum of the series 1 + 11 + 111 + 1111 + ... upto n terms.

b) If vectors $\bar{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\bar{b} = 3\hat{i} + 2\hat{j} - 5\hat{k}$ find $\bar{a} \times \bar{b}$

c) Prove that in Δ ABC $\sin(B - C) = \frac{b^2 - c^2}{a^2} \sin A$

d) Differentiate with respect to x $\frac{1 - \sin x}{1 + \sin x}$

e) Prove that $\tan^{-1}\frac{1}{7} + \tan^{-1}\frac{3}{11} = \frac{\pi}{4}$

f) Differentiate with respect to x $\log x^{\cos x}$

g) $\frac{1}{1 - 2i} + \frac{3}{1 + 4i}$ transform in to A + iB form.

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Q3) Answer any two parts of the following : **[2 × 5 = 10]**

a) If A is the sum of odd terms and B, the sum of even terms in the expansion of $(x + a)^n$, then prove that $A^2 - B^2 = (x^2 - a^2)^n$.

b) If $2\cos\theta = x - \frac{1}{x}$ and $2\cos\phi = y + \frac{1}{y}$ then prove that $2\cos(\theta + \phi) = xy - \frac{1}{xy}$.

c) If $y = \tan^{-1}\frac{4x}{1-5x^2} + \tan^{-1}\frac{2-3x}{3-2x}$, find $\frac{dy}{dx}$.

Q4) Answer any two parts of the following : **[2 × 5 = 10]**

a) If $x^m y^n = (x + y)^{m+n}$, find $\frac{dy}{dx}$.

b) Prove that curves $x^2 + 4y^2 = 8$ and $x^2 - 2y^2 = 4$ intersect orthogonally each other.

c) Find the equation of the normal to the curve $y = 4x^3 + 7x^2 - 5x - 10$ at the point (2, 2).

Q5) Answer any two parts of the following : **[2 × 5 = 10]**

a) Prove that $\bar{a} \times (\bar{b} + \bar{c}) + \bar{b} \times (\bar{c} + \bar{a}) + \bar{c} \times (\bar{a} + \bar{b}) = \bar{0}$.

b) A particle falls a distance $S = \frac{g}{k}\log\left(\frac{e^{kt} + e^{-kt}}{2}\right)$ in time t second, show that the velocity v and acceleration a satisfy the equation $a = g\frac{-k^2v^2}{g}$.

c) If $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \pi$, then prove that $x + y + z = xyz$.

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(हिन्दी अनुवाद)

नोट :- सभी प्रश्नो के उत्तर दीजिये ।

प्र.1) किन्हीं दस भागों का उत्तर दीजिये । भाग अ से य तक सही विकल्प चुनिये । [10 × 1 = 10]

अ) यदि $2\sin\theta = 1$, तो कोण θ का मान है

i) $\frac{\pi}{4}$ ii) $\frac{\pi}{6}$

iii) $\frac{\pi}{2}$ iv) कोई नही

ब) यदि $f(x) = \frac{1-x^2}{1+x^2}$, $f(\tan\theta)$ का मान है ।

i) $\sin 2\theta$ ii) $\tan 2\theta$

iii) $\cos 2\theta$ iv) कोई नही

स) सदिशों $\hat{i} - 2\hat{j} + \hat{k}$ और $4\hat{i} - 3\hat{j} - 4\hat{k}$ के मध्य का कोण है ।

i) $90°$ ii) $\cos^{-1}\left\{\sqrt{\frac{6}{41}}\right\}$

iii) $45°$ iv) $\sin^{-1}\left(\frac{3}{5}\right)$

द) श्रेणी $\frac{1}{4} - \frac{1}{2} + 1 - \ldots\ldots$ का कौन सा पद -128 है?

i) 20 वा पद ii) 10 वा पद

iii) 15 वा पद iv) 25 वा पद

य) $\frac{d}{dx}\left(\frac{2x^2}{x+7}\right)$ का मान है?

i) $\frac{3x}{x+7}$ ii) $2x^2(x+7)$

iii) $\frac{4x}{7}$ iv) कोइ नही

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र) $\lim_{x \to 2} \frac{x^2 + x - 6}{x^2 - 4}$ का मान ज्ञात करो ।

ल) $(1 + 2i)(2 - i)$ का मान ज्ञात करो ।

त) Δ ABC में सिद्ध करो कि $\frac{\sin A - \sin B}{\sin A + \sin B} = \frac{a - b}{a + b}$

थ) $\begin{vmatrix} 2 & 3 & 1 \\ 1 & 11 & -2 \\ 3 & 1 & 4 \end{vmatrix}$ का मान ज्ञात करो ।

ध) $(x + a)^n$ का प्रसार लिखो जहाँ n धनात्मक पूर्णांक है ।

न) यदि $y = 7x^5 - 5x^4 - 3x^2 + 5x + 7$, $\frac{d^3y}{dx^3}$ का मान ज्ञात करो ।

प) $(\cos\theta + i \sin\theta)^7 \times (\cos\theta - i \sin\theta)^3$ का मान ज्ञात करो ।

प्र.2) किन्हीं पाँच भागों का उत्तर दीजिये । [5 × 2 = 10]

अ) श्रेणी 1 + 11 + 111 + 1111 + ... n पदो का योगफल ज्ञात करो ।

ब) यदि सदिश $\bar{a} = 2\hat{i} - \hat{j} + \hat{k}$ और $\bar{b} = 3\hat{i} + 2\hat{j} - 5\hat{k}$ $\bar{a} \times \bar{b}$ का मान ज्ञात करो ।

स) Δ ABC में सिद्ध करो $\sin(B - C) = \frac{b^2 - c^2}{a^2} \sin A$

द) $\frac{1 - \sin x}{1 + \sin x}$ को x के सापेक्ष अवकलित करो ।

य) सिद्ध करो $\tan^{-1}\frac{1}{7} + \tan^{-1}\frac{3}{11} = \frac{\pi}{4}$

र) $\log x^{\cos x}$ का x के सापेक्ष अवकलित करो ।

ल) $\frac{1}{1 - 2i} + \frac{3}{1 + 4i}$ को A + iB के रूप में निरोपित करो ।

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प्र.3) किन्हीं दो भागों का उत्तर दीजिये । [2 × 5 = 10]

अ) यदि $(x+a)^n$ के प्रसार में विषम पदों का योग A तथा सम पदों का योग B है तो सिद्ध करो कि $A^2 - B^2 = (x^2 - a^2)^n$.

ब) यदि $2\cos\theta = x + \frac{1}{x}$ और $2\cos\phi = y + \frac{1}{y}$, तो सिद्ध करो कि $2\cos(\theta + \phi) = xy + \frac{1}{xy}$.

स) यदि $y = \tan^{-1}\frac{4x}{1+5x^2} + \tan^{-1}\frac{2+3x}{3-2x}$, $\frac{dy}{dx}$ का मान ज्ञात करो ।

प्र.4) किन्हीं दो भागों का उत्तर दीजिये । [2 × 5 = 10]

अ) यदि $x^m y^n = (x+y)^{m+n}$, $\frac{dy}{dx}$ का मान ज्ञात करो ।

ब) सिद्ध करो कि वक्र $x^2 + 4y^2 = 8$ और $x^2 - 2y^2 = 4$ परस्पर समकोण पर प्रतिच्छेदित करते है।

स) वक्र $y = 4x^3 + 7x^2 - 5x + 10$ पर अभिलम्ब का समीकरण बिन्दु (2, 2) पर ज्ञात करो ।

प्र.5) किन्हीं दो भागों का उत्तर दीजिये । [2 × 5 = 10]

अ) $\bar{a} \times (\bar{b} + \bar{c}) + \bar{b} \times (\bar{c} + \bar{a}) + \bar{c} \times (\bar{a} + \bar{b}) = \bar{0}$ सिद्ध करो ।

ब) t सेकेन्ड में एक कण दूरी $S = \frac{g}{k}\log\left(\frac{e^{kt} + e^{-kt}}{2}\right)$ गिरने में तय करता है दिखाइये कि वेग v तथा त्वरण a समीकरण $a = g\frac{-k^2v^2}{g}$ को संतुष्ट करते है ।

स) यदि $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \pi$ तो सिद्ध करो कि $x + y + z = xyz$.

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