BIT Sindri
2nd Mid-term examination – 2018
Semester I (First year)
Branch – Electrical Engineering.

B.I.T. Sindri.

B.Tech. 1st Semester 2nd Mid semester Examination 2018.

Subject: Mathematics- I **Branch: All except C.Sc. &Engg**

Time: 1.30 Hours **Full Marks : 20**

Solve **Five** questions. **Question no.1 is compulsory.**

All questions are of equal value.

1. Answer **any four** questions. Choose the correct answer. 1X4

(a) If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ and $\vec{r}$ is a position vector of any point then curl $\vec{r}$ is equal to

(i) $\vec{r}$ (ii) 3 (iii) 1 (iv) $\vec{0}$

(b) If $z = \frac{x^3+y^3}{x-y}$ then $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y}$ *is equal to*

(i) $2z$ (ii) 0 (iii) 1 (iv) z.

(c) The magnitude of greatest rate of increase of $u = x^2 + yz^2$ at the point (1,-1,3) is equal to

(i) 5 (ii) 11 (iii) 17 (iv) none of the above.

(d) If f(x) is an odd function defined in the interval $[-\pi, \pi]$ then Fourier expansion of f(x) is equal to

(i) $\sum_{n=1}^{\infty} b_n sinnx$ (ii) $\sum_{n=1}^{\infty} a_n\, cosnx$ (iii) $\frac{a_0}{2}$ (iv) 0.

(e) If $\lim_{n\to\infty} u_n \neq 0$ *then the series* $\sum u_n$ is

(i) convergent (ii) *oscillatory* (iii) divergent. (iv) none of the above.

(f) The series $\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n}$ is

(i) convergent (ii) divergent (iii) absolutely convergent (iv) none of the above.

(Turn over)

2. Test the convergence of the series $\frac{x}{1.2}+\frac{x^2}{2.3}+\frac{x^3}{3.4}+\frac{x^4}{4.5}+\ldots\ldots\ldots\infty, x>0.$ 4

3. Examine the convergence of the series $\sum\frac{\sqrt{2n-1}}{(2n+2)(2n+4)}$. 4

4. Expand $f(x) = x\sin x$ in a Fourier series in the interval $0 < x < 2\pi$. 4

5. If $u = \log(x^3+y^3+z^3-3xyz)$, show that $\left(\frac{\partial}{\partial x}+\frac{\partial}{\partial y}+\frac{\partial}{\partial z}\right)^2 u = -\frac{9}{(x+y+z)^2}$ 4

6. In a plane triangle ABC find the maximum value of cosA . cosB . cosC. 4

7. If $\vec{r} = x\,\hat{\imath} + y\,\hat{\jmath} + z\,\hat{k}$ and $\vec{r}$ is a position vector of any point and $r = |\vec{r}|$, show that

div (grad r^n)= n (n+1) r^{n-2}. 4

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