INSTITUTE OF ENGINEERING AND TECHNOLOGY, LUCKNOW

10.12.2018

IMPORTANT NOTICE

[Regarding Template of the Question Papers for End Semester Theory Examination, 2018-19]

The institute, with the aim to get NBA accreditation for its academic programs, is taking up an array of measures. One of them is adaption of AICTE recommendation for examination reforms in stages. In the process, the template of the question papers of End Semester Theory Examination, as decided in the meeting of Heads of Departments, has been tailored to fit in the framework of outcome based education.

Following are major characteristics of the new template of the question papers for end semester theory examination from Odd Semester, 2018-19 onwards for all academic programs.

1. There shall be **FIVE** questions, preferably unit wise, in the question Papers of **100 marks (3 hours duration) or 70 marks (3 hours duration)**.

2. There shall be **FOUR** questions, preferably unit wise, in the question Papers of **50 marks (2 hours duration)**.

3. All questions will carry equal marks.

4. All the questions of the question paper shall have **either FOUR parts or TWO parts** within it.

5. **Minimum 50 % parts** of **ALL questions** shall have internal choices. Thus, if any question has **FOUR** parts, **minimum TWO parts** of it shall have internal choices and If any question has **TWO** parts, **minimum ONE part** of it shall have internal choices.

6. A sample question paper, outlining the structure of a typical question paper, is given for reference.

Controller of Examination

Sample Question Paper
For subjects of 100 Marks (3 hours) Question Papers

(SEM I) ODD SEMESTER EXAMINATION 2018-19

SUBJECT NAME

[TIME: 3 hrs.] **[Max. Marks: 100]**

Note: ***Attempt All Questions. All Question carry equal marks.***

Q1.	Answer **ALL** parts.	Marks
(a)	Explain the following terms. **(i)** Rate of Convergence, **(ii)** Illconditioned system of equations **(iii)** Machine Epsilon	5
(b)	Write an algorithm for finding real root of an equation using Secant method.	5
(c)	Show at least two scenarios through graphical sketch when choice of initial guess in Newton Raphson method may lead to divergence or endless cycle. **OR** Perform four iterations of the Newton Raphson method with initial guess of **3** to find the approximate value of cube root of **23**.	5
(d)	Determine the vaue of **p** and **q** so that the order of iterative method $x_{n+1} = px_n + qa/x_n^2$ for computing root of the equation $x^3 - a = 0$ is as high as possible. **OR** Using Sturm theorem, determine the number of real roots of the given polynomial in the interval **[-3, 3]** with their multiplicity. $x^4 - 8x^2 + 1 = 0$	5
Q2.	Answer **ALL** parts.	
(a)	(i) Prove the following relation between forward difference operator and backward difference operator. $\Delta + \nabla = \Delta / \nabla - \nabla / \Delta$ **(ii)** Express x^5 in terms of Chebyshev polynomials.	10
(b)	Using Gauss elimination method with partial pivoting, solve the following system of simultaneous equations $x + y - z = 2$ $2x + 3y + 5z = -3$ $3x + 2y - 3z = 6$ **OR** Find the optimal relaxation parameter for the Successive Over Relaxation (SOR) iteration scheme for solving the given system of simultaneous equations. $4x - y = 3$ $-x + 4y - z = 2$ $-y + 4z = 3$	10

Q3. Answer **ALL** parts.

(a) What is interpolation? Find the unique polynomial **P(x)** of degree **2** or less such that **P(1) = 1, P(3) = 27, P(4) = 64** using the Lagrange interpolation method. Hence evaluate value of **P(1.5).** 10

OR

Determine the step size **h** that can be used to tabulate the value of e^x at equispaced pints in the interval **[0, 1]** so that error in the quadratic interpolation to the **f(x)** is less than **0.0005**.

(b) Using the principle of least squares fit, find an equation of the form $y = a/x + b/x^{1/2}$ that fits best the given data. 10

x	0.1	0.2	0.4	0.5	1	2
y	21	11	7	6	5	6

Q4. Answer **ALL** parts.

(a) Write Simpson's 1/3 method of integration and derive the local and global truncation error term for the method. 10

(b) Evaluate the following integral using Guass-Legendre 3-point integration method. 10

$$I = \int_0^2 dx / (x^2+2x+10)$$

OR

Given the following values of **f(x) = log x**, find the approximate values of **df(x)/dx** at **2.2** using quadratic interpolation and obtain the upper bound on the error.
f (2.0) = 0.69315, (2.2) = 0.78846, f (2.6)= 0.95551

Q5. Answer **ALL** parts.

(a) Define the following terms. 10

(i) Type-I Error
(ii) Type-II Error
(iii) Level of significance
(iv) ANOVA

(b) Prove that if every number in a sequence is multiplied by a nonzero constant, the moving average is also multiplied by this constant. 10

OR

Following table shows the observed and expected frequencies in tossing a dice 120 times. Test the hypotheses that dice is fair, using significance level of 0.05.

Face	1	2	3	4	5	6
Observed Frequency	25	17	15	23	24	16
Expected Frequency	20	20	20	20	20	20

Given that for 5 degrees of freedom, value of chi-square (x^2) at 0.95 and at 0.05 are 11.1 and 1.15 respectively.

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Sample Question Paper
For subjects of 70 Marks (3 hours) Question Paper

(SEM III) ODD SEMESTER EXAMINATION 2018-19

SUBJECT NAME

[TIME: 3 hrs.] **[Max. Marks: 70]**

Note: ***Attempt All Questions. All Question carry equal marks.***

Q1.	Answer **ALL** parts.	Marks
(a)	Explain the following terms. **(i)** Rate of Convergence, **(ii)** Illconditioned system of equations **(iii)** Machine Epsilon	3.5
(b)	Write an algorithm for finding real root of an equation using Secant method.	3.5
(c)	Show at least two scenarios through graphical sketch when choice of initial guess in Newton Raphson method may lead to divergence or endless cycle. **OR** Perform four iterations of the Newton Raphson method with initial guess of **3** to find the approximate value of cube root of **23**.	3.5
(d)	Determine the vaue of **p** and **q** so that the order of iterative method $x_{n+1} = px_n + qa/x_n^2$ for computing root of the equation $x^3 - a = 0$ is as high as possible. **OR** Using Sturm theorem, determine the number of real roots of the given polynomial in the interval **[-3, 3]** with their multiplicity. $x^4 - 8x^2 + 1 = 0$	3.5
Q2.	Answer **ALL** parts.	
(a)	(i) Prove the following relation between forward difference operator and backward difference operator. $\Delta + \nabla = \Delta/\nabla - \nabla/\Delta$ **(ii)** Express x^5 in terms of Chebyshev polynomials.	7
(b)	Using Gauss elimination method with partial pivoting, solve the following system of simultaneous equations $x + y - z = 2$ $2x + 3y + 5z = -3$ $3x + 2y - 3z = 6$ **OR** Find the optimal relaxation parameter for the Successive Over Relaxation (SOR) iteration scheme for solving the given system of simultaneous equations. $4x - y = 3$ $-x + 4y - z = 2$ $-y + 4z = 3$	7

Q3. Answer **ALL** parts. —

(a) What is interpolation? Find the unique polynomial **P(x)** of degree **2** or less such that **P(1) = 1, P(3) = 27, P(4) = 64** using the Lagrange interpolation method. Hence evaluate value of **P(1.5).** — 7

OR

Determine the step size **h** that can be used to tabulate the value of e^x at equispaced pints in the interval **[0, 1]** so that error in the quadratic interpolation to the **f(x)** is less than **0.0005**.

(b) Using the principle of least squares fit, find an equation of the form $y = a/x + b/x^{1/2}$ that fits best the given data. — 7

x	0.1	0.2	0.4	0.5	1	2
y	21	11	7	6	5	6

Q4. Answer **ALL** parts. —

(a) Write Simpson's 1/3 method of integration and derive the local and global truncation error term for the method. — 7

(b) Evaluate the following integral using Guass-Legendre 3-point integration method. — 7

$$I = \int_0^2 dx / (x^2+2x+10)$$

OR

Given the following values of **f(x) = log x**, find the approximate values of **df(x)/dx** at **2.2** using quadratic interpolation and obtain the upper bound on the error.
f (2.0) = 0.69315, (2.2) = 0.78846, f (2.6)= 0.95551

Q5. Answer **ALL** parts. —

(a) Define the following terms. — 7

(i) Type-I Error
(ii) Type-II Error
(iii) Level of significance
(iv) ANOVA

(b) Prove that if every number in a sequence is multiplied by a nonzero constant, the moving average is also multiplied by this constant. — 7

OR

Following table shows the observed and expected frequencies in tossing a dice 120 times. Test the hypotheses that dice is fair, using significance level of 0.05.

Face	**1**	**2**	**3**	**4**	**5**	**6**
Observed Frequency	25	17	15	23	24	16
Expected Frequency	20	20	20	20	20	20

Given that for 5 degrees of freedom, value of chi-square (x^2) at 0.95 and at 0.05 are 11.1 and 1.15 respectively.

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Sample Question Paper
For subjects of 50 Marks (2 hours) Question Papers

(SEM VII) ODD SEMESTER EXAMINATION 2018-19

SUBJECT NAME

[TIME: 2 hrs.] **[Max. Marks: 50]**

Note: ***Attempt All Questions. All Question carry equal marks.***

Q1.	Answer **ALL** parts**.**	Marks
(a)	Explain the following terms. **(i)** Rate of Convergence, **(ii)** Illconditioned system of equations **(iii)** Machine Epsilon	3.5
(b)	Write an algorithm for finding real root of an equation using Secant method.	3
(c)	Show at least two scenarios through graphical sketch when choice of initial guess in Newton Raphson method may lead to divergence or endless cycle. **OR** Perform four iterations of the Newton Raphson method with initial guess of **3** to find the approximate value of cube root of **23**.	3
(d)	Determine the vaue of **p** and **q** so that the order of iterative method $x_{n+1} = px_n + qa/x_n^2$ for computing root of the equation $x^3 - a = 0$ is as high as possible. **OR** Using Sturm theorem, determine the number of real roots of the given polynomial in the interval **[-3, 3]** with their multiplicity. $x^4 - 8x^2 + 1 = 0$	3
Q2.	Answer **ALL** parts**.**	
(a)	(i) Prove the following relation between forward difference operator and backward difference operator. $\Delta + \nabla = \Delta/\nabla - \nabla/\Delta$ **(ii)** Express x^5 in terms of Chebyshev polynomials.	6.5
(b)	Using Gauss elimination method with partial pivoting, solve the following system of simultaneous equations $x + y - z = 2$ $2x + 3y + 5z = -3$ $3x + 2y - 3z = 6$ **OR** Find the optimal relaxation parameter for the Successive Over Relaxation (SOR) iteration scheme for solving the given system of simultaneous equations. $4x - y = 3$ $-x + 4y - z = 2$ $-y + 4z = 3$	6

Q3.	Answer **ALL** parts**.**	
(a)	What is interpolation? Find the unique polynomial **P(x)** of degree **2** or less such that **P(1) = 1, P(3) = 27, P(4) = 64** using the Lagrange interpolation method. Hence evaluate value of **P(1.5).** **OR** Determine the step size **h** that can be used to tabulate the value of e^x at equispaced pints in the interval **[0, 1]** so that error in the quadratic interpolation to the **f(x)** is less than **0.0005**.	6.5
(b)	Using the principle of least squares fit, find an equation of the form $y = a/x + b/x^{1/2}$ that fits best the given data. **x**: 0.1, 0.2, 0.4, 0.5, 1, 2 **y**: 21, 11, 7, 6, 5, 6	6
Q4.	Answer **ALL** parts**.**	
(a)	Write Simpson's 1/3 method of integration and derive the local and global truncation error term for the method.	6.5
(b)	Evaluate the following integral using Guass-Legendre 3-point integration method. $I = \int_0^2 dx / (x^2+2x+10)$ **OR** Given the following values of **f(x) = log x**, find the approximate values of **df(x)/dx** at **2.2** using quadratic interpolation and obtain the upper bound on the error. f (2.0) = 0.69315, (2.2) = 0.78846, f (2.6)= 0.95551	6

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