Hall Ticket No | | | | | | | | | | | Question Paper Code: BCCB02

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-I

M. Tech I Semester End Examinations, January - 2020

Regulations: R18

MATHEMATICAL METHODS IN ENGINEERING

(MECH)

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each UNIT

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

UNIT – I

1. a) A discrete random variable X has the following probability distribution [7M]

X	1	2	3	4	5	6	7	8
P(X=x)	2k	4k	6k	8k	10k	12k	14k	4k

Find (i) k (ii) p(X<3) (iii) $p(X \geq 5)$

b) The probability that a man hitting a target is 1/3. If he fires 5 times , determine the probability that he fires (i) At most 3 times (ii) At least 2 times [7M]

2. a) Pumpkins were grown under two experimental conditions. Two random samples of 11 and 9 pumpkins. the sample standard deviation of their weights as 0.8 and 0.5 respectively. Assuming that the weight distributions are normal, test hypothesis that the true variances are equal. [7M]

b) A survey of 240 families with 4 children each revealed the following distribution. [7M]

Male Births	4	3	2	1	0
No of families	10	55	105	58	12

Test whether the male and female births are equally popular.

UNIT – II

3. a) Three training methods were compared to see if they led to greater productivity after training. The productivity measures for individuals trained by different methods are as follows [7M]

Method 1	36	26	31	20	34	25
Method 2	40	29	38	32	39	34
Method 3	32	18	100	21	33	27

At the 0.05 level of significance, do the three training methods lead to difference levels of productivity?

b) In 64 randomly selected hour production mean and S.D of production are 1.038 and 0.146 At 0.05 level of significant does this enable to reject the null hypothesis μ = 1 againist alternative hypothesis : μ >1. [7M]

4. a) It is claimed that a random sample of 49 tyres has a mean life of 15200 kms this sample was taken from population whose mean is 15150 kms and S.D is 1200 km test 0.05 level of significant. [7M]

b) A manufacturer claims that at least 95% of the equipment which he supplied to a factory conformed to specifications. An examination of sample of 200 pieces of equipments received 18 were faulty test the claim at 0.05 level. [7M]

UNIT – III

5. a) Find $y(0.1)$, $y(0.2)$, $z(0.1)$, $z(0.2)$ given $\frac{dy}{dx} = x + z$, $\frac{dz}{dx} = x - y^2$ and $y(0) = 2$. $z(0) = 1$ by using Taylor's series method. [7M]

b) Find the solution of differential equation $\frac{dy}{dx}$ = x-y , y(0)=1 at x = 0.1 , 0.2 ,0.3 , 0.4 and 0.5 using modified Euler's method. [7M]

6. a) Apply the 4th order R-K method to find an approximate value of y when x = 1.2 in steps of h= 0.1 given the differential equation $y' = x^2 + y^2$,y(1)=1.5. [7M]

b) Solve the initial value problem $y' + y^2 = e^x$, $y(0) = 1$ from $x = 0$ at $x = 0.5$ taking $h = 0.1$ using Adams-Bashforth-Moulton method. Starting values may be taken from Runge-Kutta method. [7M]

UNIT – IV

7. a) Solve the partial differential equation $(x^2 - y^2 - yz)p + (x^2 - y^2 - zx)q = z(x - y)$. [7M]

b) Solve $\frac{\partial^2 u}{\partial x \partial t} = e^{-t}\cos x$ given that u=0 when t = 0 and $\frac{\partial u}{\partial t} = 0$ When x = 0 show also that as t tends to ∞ , u tends to sin x. [7M]

8. a) Solve the partial differential equation $\frac{x^2}{p} + \frac{y^2}{q} = z$ [7M]

b) A bar 100 cm long, with insulated sides, has its ends kept at $0^0 C$ and $100^0 C$ until steady state conditions prevail. The two ends are then suddenly insulated and kept so. Find the temperature distribution. [7M]

UNIT – V

9. a) Solve $4u_x + u_y = 3u$ with $u(0, y) = 3e^{-y} - e^{-5y}$ by separation of variables. [7M]

b) Find the solution of the wave equation $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ corresponding to the triangular initial deflection $f(x) = \begin{cases} \frac{2k}{l}x, & where\ 0 < x < \frac{l}{2} \\ \frac{2k}{l}(l - x), & where\ \frac{l}{2} < x < l \end{cases}$ and initial velocity equal to 0. [7M]

10. a) If u is a harmonic, show that $w = u^2$ is not a harmonic function unless u is a constant. [7M]

b) Find an analytic function f(z) whose real part of it is [7M]
u = $e^x[(x^2 - y^2)cosy - 2xy\ siny)]$.

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COURSE OBJECTIVES:

The course should enable the students to:

I	Develop a basic understanding of a range of mathematics tools with emphasis on engineering applications.
II	Solve problems with techniques from advanced linear algebra, ordinary differential equations and multivariable differentiation.
III	Develop skills to think quantitatively and analyze problems critically.

COURSE OUTCOMES (COs):

CO 1	Describe the basic concepts of probability, discrete, continuous random variables and determine probability distribution, sampling distribution of statistics like t, F and chi-square.
CO 2	Understand the foundation for hypothesis testing to predict the significance difference in the sample means and the use of ANOVA technique.
CO 3	Determine Ordinary linear differential equations solvable by nonlinear ODE's.
CO 4	Explore First and second order partial differential equations.
CO 5	Analyze the solution methods for wave equation, D'Alembert solution, and potential equation, properties of harmonic functions, maximum principle, and solution by variable separation method.

COURSE LEARNING OUTCOMES (CLOs):

BCCB02.01	Describe the basic concepts of probability, discrete and continuous random variables
BCCB02.02	Determine the probability distribution to find mean and variance.
BCCB02.03	Discuss the concept of sampling distribution of statistics like t, F and chi-square.
BCCB02.04	Understand the foundation for hypothesis testing.
BCCB02.05	Apply testing of hypothesis to predict the significance difference in the sample means.
BCCB02.06	Understand the assumptions involved in the use of ANOVA technique.
BCCB02.07	Solve differential equation using single step method.
BCCB02.08	Solve differential equation using multi step methods.
BCCB02.09	Understand the concept of non- linear ordinary differential equations.
BCCB02.10	Understand partial differential equation for solving linear equations.
BCCB02.11	Solving the heat equation in subject to boundary conditions.
BCCB02.12	Solving the wave equation in subject to boundary conditions.
BCCB02.13	Understand the conditions for a complex variable to be analytic and entire function.
BCCB02.14	Understand the concept of harmonic functions.
BCCB02.15	Analyze the concept of partial differential equations by variable separation method.

MAPPING OF SEMESTER END EXAMINATION - COURSE OUTCOMES

SEE Question No		Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level
1	a	BCCB02.01	Describe the basic concepts of probability, discrete and continuous random variables	CO 1	Understand
	b	BCCB02.02	Determine the probability distribution to find mean and variance.	CO 1	Understand
2	a	BCCB02.03	Discuss the concept of sampling distribution of statistics like t, F and chi-square.	CO 1	Understand
	b	BCCB02.03	Discuss the concept of sampling distribution of statistics like t, F and chi-square.	CO 1	Understand
3	a	BCCB02.06	Understand the assumptions involved in the use of ANOVA technique.	CO 2	Understand
	b	BCCB02.05	Apply testing of hypothesis to predict the significance difference in the sample means.	CO 2	Remember
4	a	BCCB02.05	Apply testing of hypothesis to predict the significance difference in the sample means.	CO 2	Understand
	b	BCCB02.05	Apply testing of hypothesis to predict the significance difference in the sample means.	CO 2	Understand
5	a	BCCB02.07	Solve differential equation using single step method.	CO 3	Understand
	b	BCCB02.08	Solve differential equation using multi step methods.	CO 3	Understand
6	a	BCCB02.08	Solve differential equation using multi step methods.	CO 3	Understand
	b	BCCB02.08	Solve differential equation using multi step methods.	CO 3	Understand
7	a	BCCB02.10	Understand partial differential equation for solving linear equations.	CO 4	Understand
	b	BCCB02.11	Solving the heat equation in subject to boundary conditions.	CO 4	Understand
8	a	BCCB02.10	Understand partial differential equation for solving linear equations.	CO 4	Understand
	b	BCCB02.11	Solving the heat equation in subject to boundary conditions.	CO 4	Understand
9	a	BCCB02.15	Analyze the concept of partial differential equations by variable separation method.	CO 5	Understand
	b	BCCB02.12	Solving the wave equation in subject to boundary conditions.	CO 5	Understand
10	a	BCCB02.14	Understand the concept of harmonic functions.	CO 5	Understand
	b	BCCB02.13	Understand the conditions for a complex variable to be analytic and entire function.	CO 5	Understand

Signature of Course Coordinator **HOD, ME**