CBCS SCHEME

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17MAT41

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Engineering Mathematics - IV

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. From Taylor's series method, find y(0.1), considering upto fourth degree term if y(x) satisfying the equation $\frac{dy}{dx} = x - y^2$, y(0) = 1. **(06 Marks)**

b. Using Runge-Kutta method of fourth order $\frac{dy}{dx} + y = 2x$ at x = 1.1 given that y = 3 at x = 1 initially. **(07 Marks)**

c. If $\frac{dy}{dx} = 2e^x - y$, $y(0) = 2$, $y(0.1) = 2.010$, $y(0.2) = 2.040$ and $y(0.3) = 2.090$, find y(0.4) correct upto four decimal places by using Milne's predictor-corrector formula. **(07 Marks)**

OR

2 a. Using modified Euler's method find y at x = 0.2 given $\frac{dy}{dx} = 3x + \frac{1}{2}y$ with y(0) = 1 taking h = 0.1. **(06 Marks)**

b. Given $\frac{dy}{dx} + y + zy^2 = 0$ and y(0) = 1, y(0.1) = 0.9008, y(0.2) = 0.8066, y(0.3) = 0.722. Evaluate y(0.4) by Adams-Bashforth method. **(07 Marks)**

c. Using Runge-Kutta method of fourth order, find y(0.2) for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$, y(0) = 1 taking h = 0.2. **(07 Marks)**

Module-2

3 a. Apply Milne's method to compute y(0.8) given that $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$ and the following table of initial values.

x	0	0.2	0.4	0.6
y	0	0.02	0.0795	0.1762
y'	0	0.1996	0.3937	0.5689

(06 Marks)

b. Express $f(x) = x^4 + 3x^3 - x^2 + 5x - 2$ in terms of Legendre polynomials. **(07 Marks)**

c. Obtain the series solution of Bessel's differential equation $x^2y'' + xy' + (x^2 + n^2)\,y = 0$ leading to $J_n(x)$. **(07 Marks)**

OR

4 a. Given $y'' - xy' - y = 0$ with the initial conditions $y(0) = 1$, $y'(0) = 0$, compute $y(0.2)$ and $y'(0.2)$ using fourth order Runge-Kutta method. **(06 Marks)**

b. Prove $J_{-1/2}(k) = \sqrt{\dfrac{2}{\pi x}}\cos x$. **(07 Marks)**

c. Prove the Rodfigues formula $P_n(x) = \dfrac{1}{2^n n!}\dfrac{d^n y}{dx^n}(x^2 - 1)^n$ **(07 Marks)**

Module-3

5 a. Derive Cauchy-Riemann equations in Cartesian form. **(06 Marks)**

b. Discuss the transformation $w = z^2$. **(07 Marks)**

c. By using Cauchy's residue theorem, evaluate $\int_C \dfrac{e^{2z}}{(z+1)(z+2)}dz$ if C is the circle $|z| = 3$. **(07 Marks)**

OR

6 a. Prove that $\left(\dfrac{\partial^2}{\partial x^2} + \dfrac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$ **(06 Marks)**

b. State and prove Cauchy's integral formula. **(07 Marks)**

c. Find the bilinear transformation which maps $z = \infty, i, 0$ into $w = -1, -i, 1$. **(07 Marks)**

Module-4

7 a. Find the mean and standard of Poisson distribution. **(06 Marks)**

b. In an examination 7% of students score less than 35 marks and 89% of the students score less than 60 marks. Find the mean and standard deviation if the marks are normally distributed given A(1.2263) = 0.39 and A(1.4757) = 0.43 **(07 Marks)**

c. The joint probability distribution table for two random variables X and Y is as follows:

X \ Y	-2	-1	4	5
1	0.1	0.2	0	0.3
2	0.2	0.1	0.1	0

Determine:

i) Marginal distribution of X and Y
ii) Covariance of X and Y
iii) Correlation of X and Y **(07 Marks)**

OR

8 a. A random variable X has the following probability function:

x	0	1	2	3	4	5	6	7
P(x)	0	K	2k	2k	3k	K^2	$2k^2$	$7k^2+k$

Find K and evaluate $P(x \geq 6)$, $P(3 < x \leq 6)$. **(06 Marks)**

b. The probability that a pen manufactured by a factory be defective is 1/10. If 12 such pens are manufactured, what is the probability that

i) Exactly 2 are defective
ii) Atleast two are defective
iii) None of them are defective. **(07 Marks)**

c. The length of telephone conversation in a booth has been exponential distribution and found on an average to be 5 minutes. Find the probability that a random call made

i) Ends in less than 5 minutes
ii) Between 5 and 10 minutes. **(07 Marks)**

Module-5

9 a. A die is thrown 9000 times and a throw of 3 or 4 was observed 3240 times. Show that the dia cannot be regarded as an unbiased die. **(06 Marks)**

b. A group of 10 boys fed on diet A and another group of 8 boys fed on a different disk B for a period of 6 months recorded the following increase in weight (lbs):

Diet A:	5	6	8	1	12	4	3	9	6	10
Diet B:	2	3	6	8	10	1	2	8		

Test whether diets A and B differ significantly $t_{.05} = 2.12$ at 16df. **(07 Marks)**

c. Find the unique fixed probability vector for the regular stochastic matrix

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$$ **(07 Marks)**

OR

10 a. Define the terms:
- i) Null hypothesis
- ii) Type-I and Type-II error
- iii) Confidence limits **(06 Marks)**

b. The t.p.m. of a Markov chain is given by $P = \begin{bmatrix} 1/2 & 0 & 1/2 \\ 1 & 0 & 0 \\ 1/4 & 1/2 & 1/4 \end{bmatrix}$. Find the fined probabilities vector. **(07 Marks)**

c. Two boys B_1 and B_2 and two girls G_1 and G_2 are throwing ball from one to another. Each boy throws the ball to the other boy with probability 1/2 and to each girl with probability 1/4. On the other hand each girl throws the ball to each boy with probability 1/2 and never to the other girl. In the long run how often does each receive the ball? **(07 Marks)**

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17EE43

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Transmission and Distribution

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the advantages of high voltage transmission with suitable expressions. **(08 Marks)**

b. A transmission line has a span of 150 m between level supports. The conductor has a cross sectional area of 2 cm^2. The tension in the conductor is 2000 kg. If the specific gravity of the conductor materials is 9.9 gm/cm^3 and wind pressure is 1.5 kg/m length, calculate the sag. What is the vertical sag? **(12 Marks)**

OR

2 a. Define: (i) ACSR (ii) GTACSR (iii) String efficiency (iv) Vibration damper **(08 Marks)**

b. Each line of a 3-phase system is suspended by a string of 3 similar insulators. If the voltage across the line unit is 17.5 KV, calculate the line to neutral voltage. Assume that the shunt capacitance between each insulator and earth is $1/8^{th}$ of the capacitance of the insulator itself. Also find the string efficiency. **(12 Marks)**

Module-2

3 a. Derive an expression for the inductance of a conductor due to internal and external flux. **(12 Marks)**

b. The three conductors of a 3 phase line are arranged at the corners of a triangle of side 2m, 2.5 m and 4.5 m, Calculate the inductance per km of the line when the conductors are regularly transposed. The diameter of each conductor is 1.24 cm. [Refer Fig.Q3(b)]

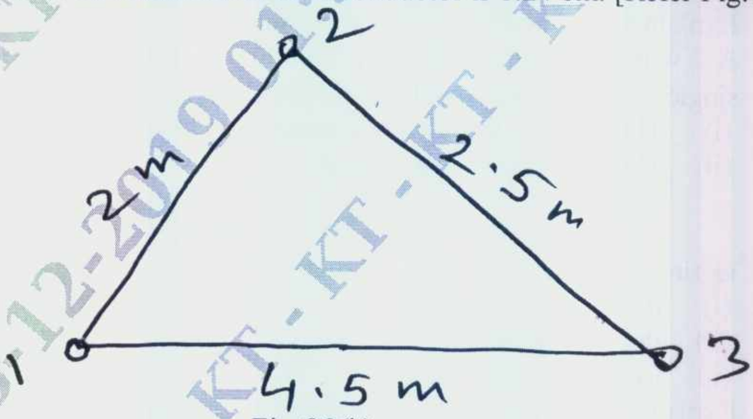

Fig.Q3(b) **(08 Marks)**

OR

4 a. Derive the expression for line to neutral capacitance for a 3 phase overhead line when the conductors are symmetrically spaced. **(12 Marks)**

b. A single phase transmission line has two parallel conductors 3 metre apart, radius of each conductor being 1 cm. Calculate the capacitance of the line per km. Given that $\epsilon_0 = 8.854 \times 10^{-12}$ F/m. **(08 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

Module-3

5 a. Explain the nominal π method for obtaining the performance calculation of medium transmission line. Draw the corresponding vector diagram. **(10 Marks)**

b. A short 3ϕ transmission line with an impedance of (6 + J8) Ω per phase has sending and receiving end voltages of 120 KV and 110 KV respectively for some receiving end load at a p.f. of 0.9 lagging. Determine:
(i) Power output
(ii) Sending end power factor. **(10 Marks)**

OR

6 a. Develop the generalized circuit constants for:
(i) Short transmission line
(ii) Medium line using nominal T method. **(10 Marks)**

b. Differentiate different types of overhead transmission line. **(06 Marks)**

c. Write a short note on Ferranti effect. **(04 Marks)**

Module-4

7 a. Define corona. What are the factors which affect corona? **(06 Marks)**

b. Explain with reference to corona:
(i) Critical descriptive voltage
(ii) Visual critical voltage **(08 Marks)**

c. Explain methods of reducing corona effect in an overhead transmission line. **(06 Marks)**

OR

8 a. Define grading of cables. Explain inter sheath grading of cable. **(08 Marks)**

b. Derive an expression for the insulation resistance of a single core cable. **(08 Marks)**

c. Write the comparison between ac and dc cable. **(04 Marks)**

Module-5

9 a. Explain Radial and Ring main distributor. **(08 Marks)**

b. A 2 wire dc distributor 200 metres long is uniformly loaded with 2 A/metre. Resistance of single wire is 0.3 Ω/km. If the distributor is fed at one end. Calculate:
(i) The voltage drop upto a distance of 150 m from feeding point
(ii) The maximum voltage drop. **(12 Marks)**

OR

10 a. Define:
(i) Reliability
(ii) Power quality
(iii) Reliability aids **(08 Marks)**

b. Explain the requirements of good distribution system. **(08 Marks)**

c. Explain the effect of disconnection of neutral in a 3 phase 4 wire systems. **(04 Marks)**

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17EE44

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Electric Motors

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Derive the torque equation of a DC motor. **(05 Marks)**

b. What are the limitation of speed control of a dc shunt motor by armature control method? Name and explain the method of overcoming these limitations. **(08 Marks)**

c. A 200V shunt motor has armature resistance of 0.1Ω and shunt field resistance of 240Ω. Its rotational losses are 236W. On full load the line current is 9.8A with the motor running at 1450rpm. Determine
   i) Mechanical power developed
   ii) Power output
   iii) Load torque
   iv) Full load efficiency. **(07 Marks)**

OR

2 a. What is Back emf? Explain its significance in DC motor operation. **(04 Marks)**

b. What is the necessity of starter? Explain with a neat diagram, the operation of a 3-point starter. **(10 Marks)**

c. A 230V, DC shunt motor runs at 800rpm and takes armature current of 50A.Find the resistance to be added to the field circuit to increase speed from 800rpm to 1000rpm at an armature current of 80A. Assume flux is proportional to field current, Armature resistance is 0.15Ω and field resistance is 250Ω. **(06 Marks)**

Module-2

3 a. Explain with a neat diagram, field test of two DC series motors to determine the efficiency of the machines. **(06 Marks)**

b. Hopkinson's test is conducted on two DC shunt machines. The supply current is 15A at 200V. The generator output current is 85A. The field current of motor and generator are2.5A and 3A respectively. The armature resistance of each machine is 0.05Ω. Find the efficiency of each machine on load. **(08 Marks)**

c. Derive torque equation of a 3ϕ induction motor and hence obtain the condition for maximum running torque. **(06 Marks)**

OR

4 a. With a net diagram, explain retardation test by elimination method to determine the stray losses and its separation into core losses and rotational losses. **(08 Marks)**

b. The field test on two mechanically coupled DC series motors with their fields connected in series and one machine running as motor while the other running as generator gave the following data :
   Motor : armature current 40A, armature voltage 200V, voltage drop across fields 15V
   Generator : Armature current 32A, armature voltage 160V, voltage drop across field 15V
   Armature resistance is 0.4Ω, calculate the efficiency of each machine. **(06 Marks)**

c. Develop torque slip characteristics of a 3ϕ induction motor when slip varies between zero and 2. **(06 Marks)**

Module-3

5 a. Develop the phasor diagram of a 3ϕ induction motor on load. **(06 Marks)**

b. List out the disadvantages of squirrel cage Induction motor. Explain with a neat diagram, the construction and operation of a double case induction motor. **(10 Marks)**

c. Show that the locus of rotor current is a semicircle through appropriate equations. **(04 Marks)**

OR

6 a. A 415V, 29.84kW, 50Hz delta connected motor gave following test data :

No load : 415V, 21A, 1250W
Blocked rotor test : 100V, 45A, 2730W

Construct the circle diagram and hence determine :

i) Line current and power factor at full load
ii) Maximum torque

Assume stator and rotor copper losses are equal at standstill. **(12 Marks)**

b. Obtain the phasor diagram and hence the locus of stator current of an Induction generator. **(04 Marks)**

c. List out the merits of Induction Generator. **(04 Marks)**

Module-4

7 a. Justify the need for a starter to start a 3ϕ induction motor. Explain with a neat diagram, the operation of a star delta starter. **(12 Marks)**

b. Explain the construction and operation of shaded pole single phase induction motor. List out its applications. **(08 Marks)**

OR

8 a. What are the limitations of speed control by stator voltage control? **(02 Marks)**

b. Explain why single phase induction motors are not self starting using double field revolving theory. **(08 Marks)**

c. Explain the construction and operation of capacitor start and run 1ϕ Induction motor. **(10 Marks)**

Module-5

9 a. Explain the principle of operation of synchronous motor. **(08 Marks)**

b. Explain with a neat diagram, the construction and operation of linear induction motor and state its application. **(12 Marks)**

OR

10 a. Explain how a synchronous motor can be operated as a synchronous condenser with change in excitation. **(08 Marks)**

b. With a neat diagram, explain the construction and operation of stepper motor. **(12 Marks)**

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17EE45

Fourth Semester B.E. Degree Examination, June/July 2019
Electromagnetic Field Theory

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Obtain the relationship between rectangular and cylindrical co-ordinate system. **(06 Marks)**

b. Find dot product, cross product and unit vector of $\overline{A}$ for the following vectors :
$\overline{A} = 3\overline{ax} + 4\overline{ay} - 5\overline{az}$
$\overline{B} = -6\overline{ax} + 2\overline{ay} + 4\overline{az}$ **(08 Marks)**

c. State and explain Coulomb's law in vector form. **(06 Marks)**

OR

2 a. Give the Cartesian coordinates of the vector field $\overline{H} = 20\overline{a\rho} - 10\overline{aQ} + 3\overline{az}$ at the point P(x=5, y=2, z=−1). **(08 Marks)**

b. State the prove Gauss divergence theorem. **(06 Marks)**

c. If $\overline{D} = (2y^2z - 8xy)\overline{ax} + (4xyz - 4x^2)\overline{ay} + (2xy^2 - 4z)\overline{az}$. Determine div of D at P(1, −2, 3). **(06 Marks)**

Module-2

3 a. Prove that electric-field intensity is expressed as negative gradient of scalar potential. **(07 Marks)**

b. Derive current continuity equation with usual notation. **(06 Marks)**

c. Obtain the boundary conditions between Dielectric and Conductors. **(07 Marks)**

OR

4 a. Given V = $2x^2y - 5z$ at point P(−4, 3, 6) find potential, electrified intensity and volume charge density. **(05 Marks)**

b. Derive the expression for capacitor of a parallel plate capacitor containing 2 dielectrics . **(07 Marks)**

c. Obtain the expression for energy density in free space for electrostatic field. **(08 Marks)**

Module-3

5 a. Derive Laplace equation and Poisson's equation from point form of gauss law in all the three co-ordinate system. **(06 Marks)**

b. Prove the uniqueness of solution using uniqueness theorem. **(08 Marks)**

c. State and explain Biot-Savart's law and Ampere's circuit law. **(06 Marks)**

OR

6 a. Verify the potential field given satisfies the Laplace's equation $V = 2x^2 - 3y^2 + z^2$. **(05 Marks)**

b. Obtain the equation for $\text{curl}(\nabla \times \overline{H}) = \bar{J}$ by considering differential surface element and equations. **(08 Marks)**

c. If a field given $\overline{F} = (x + 2y + az)\overline{ax} + (bx - 3y - z)\overline{ay} + (4x + cy + 2z)\overline{az}$, find the constants a, b, c such that the field is irrotational. **(07 Marks)**

Module-4

7 a. State and explain Lorentz force equation. **(05 Marks)**

b. A point charge Q = 18nc has a velocity of 5 × 10^6m/s in the direction $\overline{au} = 0.6\overline{ax} + 0.75\overline{ay} + 0.3\overline{az}$. Calculate the magnitude of the force exacted on the charge by the field :

i) $\overline{E} = -3\overline{ax} + 4\overline{ay} + 6\overline{az}$ KV / m

ii) $\overline{B} = -3\overline{ax} + 4\overline{ay} + 6\overline{az}$ mT

iii) $\overline{B}$ and $\overline{E}$ together acting. **(08 Marks)**

c. Derive the boundary conditions at the interface between two magnetic materials of different permeabilites. **(07 Marks)**

OR

8 a. Derive the equation for magnetic force between two differential current elements. **(07 Marks)**

b. Derive the expression for the inductance of a solenoid and torroid. **(07 Marks)**

c. Consider an air core torroid with 500 turns cross sectional area of 6cm^2 and mean radius of 15cm and carries current of 4amps. Find reluctance, $\overline{B}, \overline{H}$. **(06 Marks)**

Module-5

9 a. State and explain Faraday's law. **(05 Marks)**

b. List Maxwell's equations for time varying fields in integral form and point form. **(08 Marks)**

c. Explain skin depth and skin effect. Derive the expression for skin depth. **(07 Marks)**

OR

10 a. State and explain Pointing theorem with derivation $\overline{P} = \overline{E} \times \overline{H}$. **(07 Marks)**

b. Derive expression for displacement current density for time varying fields. **(07 Marks)**

c. A 300MHz uniform plane wave propagates through fresh water for which $\sigma = 0$, $\mu_r = 1$, $\epsilon_r = 78$. Calculate attenuation constant, phase constant, wavelength intrinsic impedance ($\alpha, \beta, \lambda, \eta$). **(06 Marks)**

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17MATDIP41

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Find the rank of the matrix:
$$A = \begin{bmatrix} 2 & 3 & 5 & 4 \\ 0 & 2 & 3 & 4 \\ 4 & 8 & 13 & 12 \end{bmatrix}$$ by elementary row transformations. **(08 Marks)**

b. Solve by Gauss elimination method
$$2x + y + 4z = 12$$
$$4x + 11y - z = 33$$
$$8x - 3y + 2z = 20$$
(06 Marks)

c. Find all the eigen values for the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ **(06 Marks)**

OR

2 a. Reduce the matrix
$$\begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$$ into its echelon form and hence find its rank. **(06 Marks)**

b. Applying Gauss elimination method, solve the system of equations
$$2x + 5y + 7z = 52$$
$$2x + y - z = 0$$
$$x + y + z = 9$$
(06 Marks)

c. Find all the eigen values for the matrix $A = \begin{bmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{bmatrix}$ **(08 Marks)**

Module-2

3 a. Solve $\frac{d^4y}{dx^4} - \frac{2d^3y}{dx^3} + \frac{d^2y}{dx^2} = 0$ **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} - \frac{6dy}{dx} + 9y = 5e^{-2x}$ **(06 Marks)**

c. Solve $\frac{d^2y}{dx^2} + y = \sec x$ by the method of variation of parameters. **(08 Marks)**

OR

4 a. Solve $\frac{d^3y}{dx^3} + y = 0$ **(06 Marks)**

b. Solve $y'' + 3y' + 2y = 12x^2$ **(06 Marks)**

c. Solve by the method of undetermined coefficients : $y'' - 4y' + 4y = e^x$ **(08 Marks)**

Module-3

5 a. Find the Laplace transforms of $\sin 5t \cos 2t$ **(06 Marks)**

b. Find the Laplace transforms of $(3t + 4)^3$ **(06 Marks)**

c. Express $f(t) = \begin{cases} \sin 2t & 0 < t < \pi \\ 0 & t > \pi \end{cases}$, in terms of unit step function and hence find $L[f(t)]$. **(08 Marks)**

OR

6 a. Find the Laplace transforms of $\dfrac{\sin^2 t}{t}$ **(06 Marks)**

b. Find the Laplace transform of $2^t + t \sin t$ **(06 Marks)**

c. If $f(t) = t^2$, $0 < t < 2$ and $f(t + 2) = f(t)$, for $t > 2$, find $L[f(t)]$. **(08 Marks)**

Module-4

7 a. Find the Laplace Inverse of
$$\frac{1}{(s+1)(s-1)(s+2)}$$ **(08 Marks)**

b. Find the inverse Laplace transform of $\dfrac{3s+7}{s^2-2s-3}$. **(06 Marks)**

c. Solve $y'' + 2y' - 3y = \sin t$, $y(0) = 0$, $y'(0) = 0$. **(06 Marks)**

OR

8 a. Find the inverse Laplace transform of
$$\log\left(\frac{s+a}{s+b}\right)$$ **(06 Marks)**

b. Find the inverse Laplace transform of $\dfrac{4s-1}{s^2+25}$ **(06 Marks)**

c. Find the inverse Laplace of $y'' - 5y' + 6y = e^t$ with $y(0) = y'(0) = 0$. **(08 Marks)**

Module-5

9 a. State and prove Addition theorem on probability. **(05 Marks)**

b. A student A can solve 75% of the problems given in the book and a student B can solve 70%. What is the probability that A or B can solve a problem chosen at random. **(06 Marks)**

c. Three machines A, B, C produce 50%, 30% and 20% of the items in a factory. The percentage of defective outputs of these machines are 3, 4 and 5 respectively. If an item is selected at random, what is the probability that it is defective? If a selected item is defective, what is the probability that it is from machine A? **(09 Marks)**

OR

10 a. Find the probability that the birth days of 5 persons chosen at random will fall in 12 different calendar months. **(05 Marks)**

b. A box A contains 2 white balls and 4 black balls. Another box B contains 5 white balls and 7 black balls. A ball is transferred from box A to box B. Then a ball is drawn from box B. Find the probability that it is white. **(06 Marks)**

c. State and prove Baye's theorem. **(09 Marks)**

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