CBCS SCHEME

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15MAT41

Fourth Semester B.E. Degree Examination, July/August 2021
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks:80

Note: ***Answer any FIVE full questions.***

1 a. Find y at x = 0.4 correct to 4 decimal places given $\frac{dy}{dx} = 2xy + 1$; y(0) = 0 applying Taylor's series method upto third degree term. **(05 Marks)**

b. Using modified Euler's method find y(0.2) correct to four decimal places solving the equation $y' = x - y^2$, y(0) = 1 taking h = 0.1. Use modified Euler's formula twice. **(05 Marks)**

c. Use fourth order Runge – Kutta method to solve $(x + y)\frac{dy}{dx} = 1$, y(0.4) = 1 at x = 0.5 correct to four decimal places. **(06 Marks)**

2 a. 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 by taking h = 0.2. **(05 Marks)**

b. Apply Milne's method to find y at x = 1.4 correct to four decimal places given $\frac{dy}{dx} = x^2 + \frac{y}{2}$ and the following data y(1) = 2, y(1.1) = 2.2156, y(1.2) = 2.4649, y(1.3) = 2.7514. **(05 Marks)**

c. Find the value of y at x = 4.4 by applying Adams – Bashforth method given that $5x\frac{dy}{dx} + y^2 - 2 = 0$ with the initial values of y : $y_0 = 1$, $y_1 = 1.0049$, $y_2 = 1.0097$, $y_3 = 1.0142$ corresponding to the values of x : $x_0 = 4$, $x_1 = 4.1$m, $x_2 = 4.2$, $x_3 = 4.3$. **(06 Marks)**

3 a. Apply Milne's predictor – corrector method to compute y(0.4) given the differential equation $y'' + 3xy' - 6y = 0$ and the following table of initial values. **(05 Marks)**

x	0	0.1	0.2	0.3
y	1	1.03995	1.13803	1.29865
y'	0.1	0.6955	1.258	1.873

b. Prove that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cdot \sin x$. **(05 Marks)**

c. Express $f(x) = 4x^3 + 6x^2 + 7x + 2$ in terms of Legendre polynomials. **(06 Marks)**

4 a. Given $y'' - xy' - y = 0$ with the initial conditions y(0) = 1, y'(0) = 0, compute y(0.2) using fourth order Runge – Kutta method. **(05 Marks)**

b. Prove the Rodrigues formula $P_n(x) = \frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2 - 1)^n$. **(05 Marks)**

c. Obtain the series solution of Bessel's differential equation $x^2y'' + xy' + (x^2 + n^2)y = 0$. **(06 Marks)**

5 a. State and prove Cauchy's – Riemann equation in polar form. **(05 Marks)**

b. Discuss the transformation $W = Z^2$. **(05 Marks)**

c. Using Cauchy's residue theorem evaluate :

$\int_C \frac{z\cos z}{(z - \frac{\pi}{2})^3} dz$ where $C : |z - 1| = 1$. **(06 Marks)**

6 a. Find an analytical function whose real part is $e^{-x}\left[(x^2-y^2)\cos y + 2xy\sin y\right]$. (05 Marks)

b. Evaluate : $\int_C \frac{e^{2z}}{(z+1)(z-2)} dz$ where C is the circle $|z| = 3$. (05 Marks)

c. Find the bilinear transformation which maps the points $Z = 1, i, -1$ into $w = 0, 1, \infty$. (06 Marks)

7 a. A random variate X has the following probability function for various values of x

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

Find : i) K ii) Evaluate $P(x < 6)$ $P(x \geq 6)$ and $P(0 < x < 5)$. (05 Marks)

b. Find the mean and standard deviation of the exponential distribution. (05 Marks)

c. The joint probability distribution table for two random variables X and Y 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) Expectation of X
iii) S.D of Y
iv) Covariance of X and Y
v) Correlation of X and Y. (06 Marks)

8 a. A random variable x has the following density function :

$$f(x) = \begin{cases} Kx^2, & 0 < x < 3 \\ 0, & \text{otherwise} \end{cases}$$

Evaluate : i) K ii) $P(1 < x < 2)$ iii) $P(x \leq 1)$ iv) $P(x > 1)$ v) Mean. (05 Marks)

b. In a quiz contest of answering 'Yes' or 'No' what is the probability of guessing atleast 6 answers correctly out of 10 questions asked? Also find the probability of the same if there are 4 options for a correct answer. (05 Marks)

c. In a normal distribution 31% of the items are under 45 and 8% of the items are over 64. Find the mean and S.D of the distribution. It is given that if :

$$P(Z) = \frac{1}{\sqrt{2\pi}} \int_0^z e^{-z^2/2} dz$$

then $A(-0.4958) = 0.19$ and $A(1.405) = 0.42$. (06 Marks)

9 a. The weights of 1500 ball bearings are normally distributed with a mean of 635gms and S.D of 1.36gms. If 300 random samples of size 36 are drawn from this population, determine the expected mean and S.D of the sampling distribution of means if sampling is done : i) with replacement ii) without replacement. **(05 Marks)**

b. Two athletes A and B were tested according to the time (in seconds) to run a particular race with the following results.

Athlete A	28	30	32	33	33	29	34
Athlete B	29	30	30	24	27	29	

Test whether you can discriminate between the two Athletes. ($t_{0.05} = 2.2$ and $t_{0.02} = 2.72$ for 11d.f). **(05 Marks)**

c. A student's study habits are as follows. If he studies one night, he is 70% sure not to study the next night. On the other hand if he does not study one night, he is 60% sure not to study the next night. In the long run how often does he study? **(06 Marks)**

10 a. The mean and S.D of the maximum loads supported by 60 cables are 11.09 tonnes and 0.73 tonnes respectively. Find : i) 95% ii) 99% confidence limits for mean of the maximum loads of all cables produced by the company. **(05 Marks)**

b. Fit a Poisson distribution for the following data and test the goodness of fit given that $\chi^2_{0.05} = 7.815$ for 3d.f.

x	0	1	2	3	4
f	122	60	15	2	1

(05 Marks)

c. Show that $P = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$ is a regular stochastic matrix. Also find the associated unique fixed probability vector. **(06 Marks)**

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15ME43

Fourth Semester B.E. Degree Examination, July/August 2021
Applied Thermodynamics

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer any FIVE full questions.***
2. ***Use of thermodynamic data hand book permitted.***
3. ***Draw neat sketches, wherever necessary.***

1 a. Compare Otto, Diesel and Dual cycles for the same compression ratio and heat addition. Use P-V and T-S diagrams. **(06 Marks)**

b. What is an "Air Standard Cycle"? why are such cycles conceived? **(02 Marks)**

c. An engine working on the Otto cycle has an air standard efficiency of 56% and rejects 544 kJ/kg of heat. The pressure and temperature of air at the beginning of compression are 0.1 MPa and 60°C respectively. Compute
(i) Compression ratio of the engine.
(ii) Work done per kg of air.
(iii) Pressure and temperature at the end of compression.
(iv) Maximum pressure of the cycle. **(08 Marks)**

2 a. Discuss the various methods employed to improve the thermal efficiency of an open cycle G.T. Plant. **(09 Marks)**

b. A simple Gas turbine unit consists of single stage compressor, regenerator, combustion chamber and single stage turbine. The initial pressure and temperature are 1.03 bar and 15.5°C. The pressure ratio of the cycle is 5. The maximum temperature of the cycle is limited to 813 K. The isentropic efficiency of the compressor and turbine are 85% and 80% respectively. Take C_P = 1 kJ/kgK and γ = 1.4 for air and gases and find the air flow rate through the plant. If the power output of the turbine is 1560 kW. Neglect the mass of fuel. Take effectiveness of regenerator = 0.85. Compute the thermal efficiency of the plant. **(07 Marks)**

3 a. Compare Carnot and Rankine cycles for a steam power plant. Enumerate the importance of mean temperature of heat addition and explain the various methods employed to increase the mean temperature of heat addition. **(08 Marks)**

b. In a reheat cycle, steam at 500°C expands in a HP turbine till it is saturated vapor. It is reheated at constant pressure to 400°C and then expands in a L.P. turbine to 40°C. If the maximum moisture content at the exhaust of the turbine is limited to 15% find (i) The reheat pressure (ii) Pressure at the inlet of the HP turbine. (iii) Net specific work output (iv) the efficiency (v) The steam rate
Assume all ideal processes. Use Mollier diagram. **(08 Marks)**

4 a. Obtain an expression for the thermal efficiency of a Regenerative Rankine cycle with single open heater. Obtain an expression for mass of steam bled. **(06 Marks)**

b. Discuss how of 'diminishing returns' with regard to efficiency of regenerative rankine cycle with 'n' heaters. **(04 Marks)**

c. A regenerative cycle operates with steam supplied at 30 bar and 300°C and condenser pressure of 0.08 bar. The extraction points for two heaters (open type) are at 3.5 bar and 0.7 bar respectively. Calculate thermal efficiency. Neglect pump work. Use Mollier diagram. **(06 Marks)**

5 a. Define (i) Stoichiometric air (ii) Excess air (iii) Enthalpy of formation (iv) Combustion efficiency. **(06 Marks)**

b. With a neat sketch, explain the working principle of an Orsat apparatus. **(05 Marks)**

c. An S.I. Engine uses a hydrocarbon fuel of unknown composition and the volumetric analysis of the exhaust gas gives the following :
CO_2 – 14.4%, CO – 0.4%, O_2 – 5.5%, N_2 – 79.7%
Calculate on mass basis.
(i) Percentage theoretical air.
(ii) Air fuel ratio (actual)
(iii) Composition of the fuel on mass basis. **(05 Marks)**

6 a. Discuss the Willan's line methods employed to determine the fictional power of an I.C. Engine. **(04 Marks)**

b. With a P-θ diagram, explain the combustion phenomenon in C.I. Engines. **(06 Marks)**

c. The following data is from a trial on a 4-cylinder, 4-stroke petrol engine which is coupled to a hydraulic dynamometer at constant speed and full throttle:
B.P with all cylinders working : 14.7 kW
B.P with cylinder 1 cutoff : 10.4 kW
B.P with cylinder 2 cutoff : 10.3 kW
B.P. with cylinder 3 cutout : 10.4 kW
B.P. with cylinder 4 cutout : 10.2 kW
Petrol used = 5.44 kg/h, C.V. of the fuel = 42000 kJ/kg
Diameter and stroke of piston : 8 cm and 10 cms respectively,
Clearance volume = 100 cm^3
Find (i) the mechanical efficiency (ii) Relative efficiency on IP basis. **(06 Marks)**

7 a. Explain the following terms with regard to refrigeration :
(i) Refrigeration effect
(ii) Unit of refrigeration
(iii) Desirable properties of a refrigerant. **(06 Marks)**

b. A E12 vapor compression refrigeration system has a conducting temperature of 50°C and evaporating temperature of 0°C. The refrigeration capacity is 7 tons. The vapor leaving the evaporator is saturated and the liquid leaving the condenser is also saturated. Assuming isentropic compression. Determine
(i) Flow rate of refrigerant.
(ii) Power required to run the compressor.
(iii) Heat rejected in the plant.
(iv) COP of the system.
Use the following properties :

Temp °C	Pressure bar	h_f kJ/kg	h_g kJ/kg	S_f kJ/kg K	S_g kJ/kg K
50	12.199	84.864	206.298	03.34	0.6792
0	3.086	36.022	187.397	0.1418	0.696

(07 Marks)

c. Give a case study on Cold storage. **(03 Marks)**

8 a. Explain the following terms with regard to air conditioning :
(i) Dry air
(ii) Specific humidity
(iii) Humidity ratio
(iv) Degree of saturation. **(08 Marks)**

b. The Sling psychrometer reads 40°C DBT and 28°WBT. Calculate :
(i) Specific humidity
(ii) Vapor density of an air.
(iii) Dew point temperature
(iv) Enthalpy of the mixture per kg of dry air.
Assume atmospheric pressure to be 1.03 bar. **(08 Marks)**

9 a. Derive an expression for minimum work of compression for a 2-stage reciprocating air compressor with perfect intercooling. **(08 Marks)**

b. A three stage compressor is used to compress H_2 from 1.04 bar to 35 bar. The compression in all stages follows the law $PV^{1.25} = C$. The temperature at the inlet of compressor is 288 K. Neglecting clearance and assuming perfect inter cooling find the power required to drive the compressor in kW to deliver 14 m^3/min of H_2 measured at inlet conditions. Also find the intermediate pressures. **(08 Marks)**

10 a. Derive an expression for optimum pressure ratio for maximum discharge and further obtain an expression for maximum discharge. **(07 Marks)**

b. What do you understand by super saturated or metastable flow in nozzles? **(04 Marks)**

c. The inlet conditions of steam to a convergent – divergent nozzle is 2.2 MN/m^2 and 260°C. The exit pressure is 0.4 MN/m^2. Assuming frictionless flow upto the throat and a nozzle efficiency of 85 percent, determine (i) the flow rate for a throat area of 32.2 cm^2 (ii) exit area. **(05 Marks)**

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15ME44

Fourth Semester B.E. Degree Examination, July/August 2021
Fluid Mechanics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions.

1 a. What is surface tension? Derive equation of intensity of pressure for (i) Droplet (ii) Bubble. **(05 Marks)**

b. Briefly explain U-tube differential manometer. Derive the expression for pressure difference at two points using U-tube differential manometer. **(06 Marks)**

c. A tank contains water upto a depth of 2m and above it an oil of specific gravity 0.9 for a depth of 1m. Find the pressure intensity:
(i) at the interface of two liquids (ii) at the bottom of the tank. **(05 Marks)**

2 a. Briefly explain the conditions of equilibrium of a floating body. **(04 Marks)**

b. A circular plate 3.0 m diameter having a concentric circular hole of diameter 1.5 m is immersed in water in such a way that its greatest and least depth below the free surface are 4m and 1.5 m respectively. Determine the total pressure and position of centre of pressure on one face of the plate. **(05 Marks)**

c. Derive an expression for metacentric height analytically. **(07 Marks)**

3 a. Briefly explain different types of fluid flow. **(05 Marks)**

b. Derive expression for continuity equation for three dimensional flow in Cartesian coordinates. **(05 Marks)**

c. A stream function is given by $\psi = 3xy$, determine:
(i) Whether flow is possible
(ii) Whether flow is rotational or irrotational
(iii) Acceleration components at a point (1, 1) **(06 Marks)**

4 a. Derive Bernoullis equation from first principle. **(08 Marks)**

b. A horizontal venturimeter with inlet and throat diameters of 300 mm and 100 mm respectively is used to measure the discharge of water. The intensity of pressure is 130 kN/m^2 at inlet section whereas the vacuum pressure head at throat is 350 mm of mercury. Assuming that the 3% of head is lost between the inlet and throat, find the value of coefficient of discharge [C_d], and the amount of discharge. **(08 Marks)**

5 a. An oil of viscosity 0.1 Pa.S and relative density is 0.9 flows between two parallel plates 25 mm apart with a mean velocity of 1.8 m/sec. Determine:
(i) Maximum velocity
(ii) Shear stress at the boundary
(iii) Loss of head in a distance of 10 m
(iv) Velocity at 5 mm from the plate. **(07 Marks)**

b. Define Reynolds Number. What is its significance? **(04 Marks)**

c. Sketch the shear stress and velocity profile across a section of a circular pipe, for viscous flow. What are the expressions governing shear stress and velocity profile? **(05 Marks)**

6 a. Briefly explain, with neat sketches that types of energy or head losses through pipe. **(06 Marks)**

b. A horizontal pipe line 40 meters long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 mts of its length the pipe is 15 cm diameter and then its diameter is suddenly, enlarged to 30 cm. The height of water level in the tank is 8 meters above the center of pipe. Considering all losses of head which occur, determine the rate of flow. Take f = 0.01 for both the sections of the pipe. **(06 Marks)**

c. What do you understand by pipes in parallel? What are the characteristics of pipes in parallel? **(04 Marks)**

7 a. Briefly explain about Boundary layer separation and methods to control it. **(05 Marks)**

b. A square plate of side 2m is moved in a stationary air of density 1.2 kg/m^3, with a velocity of 50 km/hr. If coefficients of drag and lift are 0.2 and 0.8 respectively, determine:
(i) Lift force
(ii) Drag force
(iii) Resultant force and its direction
(iv) Power required to keep the plate in motion. **(06 Marks)**

c. Briefly explain (i) Friction Drag (ii) Pressure drag **(05 Marks)**

8 a. Briefly explain the following dimensionless numbers and their applications:
(i) Reynolds Number
(ii) Mach Number **(05 Marks)**

b. The capillary rise 'H' of a fluid of mass density 'e' and surface tension 'σ' in a tube of diameter 'd' depends upon the angle of contact 'α' and acceleration due to gravity 'g'. Obtain an expression for 'H' using Buckingham π theorem in the following form

$$\frac{H}{d} = \phi\left[\frac{\sigma}{egd^2}, \alpha\right]$$ **(06 Marks)**

c. What is Similitude? Briefly explain the types of similarities between a model and prototype. **(05 Marks)**

9 a. Briefly explain the basic thermodynamic relations useful for gases. **(05 Marks)**

b. Obtain an expression for velocity of sound for compressible fluid undergoing isothermal process. **(06 Marks)**

c. Find the velocity of bullet fired in standard air if the Mach angle is 30°. Take R = 287.14 J/kgK and K = 1.4 for air. Assume temperature as 15°C. **(05 Marks)**

10 a. Briefly explain about Oblique Shocks. **(05 Marks)**

b. Summarize the steps involved in CFD analysis. **(07 Marks)**

c. Write a note on CFD applications. **(04 Marks)**

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CBCS SCHEME

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15ME46B/15MEB406

Fourth Semester B.E. Degree Examination, July/August 2021
Mechanical Measurements and Metrology

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions.

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.

1 a. Define metrology. State the objectives of metrology. **(08 Marks)**
b. Explain line standards and end standard with suitable examples. **(04 Marks)**
c. Calculate the dimensions using M-87 set 49.3825 mm. **(04 Marks)**

2 a. Explain with neat sketch "Imperial Standard Yard". **(05 Marks)**
b. Four end bars of basic length 125 mm are to be calibrated using standard bar of 500 mm whose actual length is 499.9991 mm. It was also found that length of bars B, C and D in comparison with A are +0.0001 mm, +0.0005 mm and –0.0002 mm respectively and the length of all the four bars put together in comparison with the standard bar is +0.0003 mm longer. Find the actual length of each end bars. **(05 Marks)**
c. Distinguish between sine bar and sine centre with suitable sketches. **(06 Marks)**

3 a. Explain any two types of fits. **(06 Marks)**
b. Distinguish between hole basis and shaft basis system of fits. **(05 Marks)**
c. List and explain gauge materials used for making gauges. **(05 Marks)**

4 a. Classify different types of comparators. **(05 Marks)**
b. Explain with neat sketch the working of LVDT. **(06 Marks)**
c. Explain with neat sketch working of Solex Pneumatic Comparator. **(05 Marks)**

5 a. Explain with sketch for measurement of effective diameter by three wire method. **(08 Marks)**
b. Explain with neat sketch tool maker's microscope. **(08 Marks)**

6 a. Describe with neat sketch gear roll tester for composite error (Parkinson gear tester). **(08 Marks)**
b. Define best wire size. Derive an expression for best size wire. **(08 Marks)**

7 a. Define measurement. Describe with suitable example, generalized measurement system. **(08 Marks)**
b. Define the following terms: (i) Accuracy (ii) Precision (iii) Calibration **(03 Marks)**
c. List the advantages of electrical transducer elements over mechanical transducer elements. **(05 Marks)**

8 a. Describe in detail a ballast circuit. **(06 Marks)**
b. List the materials and uses of piezoelectric crystals used in piezoelectric transducer. **(04 Marks)**
c. Describe with neat sketch of Cathode-Ray Oscilloscope (CRO). **(06 Marks)**

9 a. Explain with neat sketch hydraulic dynamometers. **(08 Marks)**
b. Explain with neat sketch pirani thermal conductivity gauge. **(08 Marks)**

10 a. Describe with neat sketch the working of optical pyrometer. **(08 Marks)**
b. Describe with neat sketch of a simple resistance bridge arrangement for strain measurement. **(08 Marks)**

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CBCS SCHEME

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15MATDIP41

Fourth Semester B.E. Degree Examination, July/August 2021
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions.

1 a. Determine the rank of the matrix $A = \begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$ by applying elementary row transformations. **(05 Marks)**

b. Find the inverse of the matrix $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ using Cayley Hamilton theorem. **(05 Marks)**

c. Solve by Gauss elimination method

$2x + y + 4z = 12$

$4x + 11y - z = 33$

$8x - 3y + 2z = 20$ **(06 Marks)**

2 a. Find the eigen values of $A = \begin{bmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{bmatrix}$ **(05 Marks)**

b. Solve the system of equations by Gauss elimination method.

$x + y + z = 9$

$x - 2y + 3z = 8$

$2x + y - z = 3$ **(06 Marks)**

c. Find the rank of the matrix by reducing it to echelon form.

$\begin{bmatrix} -2 & -1 & -3 & -1 \\ 1 & 2 & 3 & 1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 \end{bmatrix}$ **(05 Marks)**

3 a. Solve $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 5y = 0$ subject to $\frac{dy}{dx} = 2$, $y = 1$ at $x = 0$. **(05 Marks)**

b. Solve $(4D^4 - 4D^3 - 23D^2 + 12D + 36)y = 0$. **(05 Marks)**

c. Solve by the method of variation of parameters $\frac{d^2y}{dx^2} + y = \tan x$. **(06 Marks)**

4 a. Solve $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = e^{2x} + \cos 2x$. **(05 Marks)**

b. Solve $y'' + 2y' + y = 2x + x^2$ **(05 Marks)**

c. Using the method of undetermined coefficients, solve $y'' - 5y' + 6y = e^{3x} + x$ **(06 Marks)**

5 a. Find the Laplace transform of (i) $\frac{e^{-at}-e^{-bt}}{t}$ (ii) $\sin 5t\cos 2t$ **(05 Marks)**

b. Find the Laplace transform of

$$f(t)=\begin{cases} E, & 0<t<\frac{a}{2} \\ -E, & \frac{a}{2}<t<a \end{cases} \quad \text{where } f(t+a)=f(t)$$ **(06 Marks)**

c. Express $f(t)=\begin{cases} t, & 0<t<4 \\ 5, & t>4 \end{cases}$ in terms of unit step function and hence find L[f(t)]. **(05 Marks)**

6 a. Express $f(t)=\begin{cases} \cos t, & 0<t<\pi \\ \cos 2t, & \pi<t<2\pi \\ \cos 3t, & t>2\pi \end{cases}$ in terms of unit step function and hence find its Laplace transform. **(06 Marks)**

b. Find the Laplace Transform of (i) $t\sin at$ (ii) t^5e^{4t} **(05 Marks)**

c. If $f(t)=t^2$, $0<t<2$ and $f(t+2)=f(t)$ for $t>2$, find L[f(t)]. **(05 Marks)**

7 a. Find the inverse Laplace Transform of $\frac{2s-1}{s^2+4s+29}$. **(05 Marks)**

b. Find the inverse Laplace transform of $\cot^{-1}\left(\frac{s}{a}\right)$. **(05 Marks)**

c. Solve by using Laplace Transforms $\frac{d^2y}{dt^2}+4\frac{dy}{dt}+4y=e^{-t}$; $y(0)=0$, $y'(0)=0$. **(06 Marks)**

8 a. Solve the initial value problem $y''+4y'+3y=e^{-t}$ conditions with $y(0)=1$, $y'(0)=1$ using Laplace Transforms. **(06 Marks)**

b. Find the inverse Laplace Transform of $\frac{s+2}{s^2(s+3)}$ **(05 Marks)**

c. Find the inverse Laplace Transform of $\log\left[\frac{s^2+4}{s(s+4)(s-4)}\right]$ **(05 Marks)**

9 a. A box contains 3 white, 5 black and 6 red balls. If a ball is drawn at random, what is the probability that it is either red or white? **(05 Marks)**

b. The probability that a person A solves the problem is 1/3, that of B is 1/2 and that of C is 3/5. If the problem is simultaneously assigned to all of them what is the probability that the problem is solved? **(05 Marks)**

c. Three machines A, B and C produce respectively 60%, 30%, 10% of the total number of items of a factory. The percentages of defective output of these machines are respectively 2%, 3% and 4%. An item is selected at random and is found defective. Find the probability that the item was produced by machine C. **(06 Marks)**

10 a. State and prove Baye's theorem. **(05 Marks)**

b. If A and B are events with $P(A\cup B)=\frac{3}{4}$, $P(\overline{A})=\frac{2}{3}$ and $P(A\cap B)=\frac{1}{4}$, find P(A), P(B) and $P(A\cap \overline{B})$. **(05 Marks)**

c. Three students A, B, C, write an entrance examination. Their chances of passing are 1/2, 1/3 and 1/4 respectively. Find the probability that
(i) atleast one of them passes (ii) all of them pass (iii) atleast two of them passes. **(06 Marks)**

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