BTS – IV– 04.14 – 0067

A

B.Tech. Degree IV Semester Examination April 2014

IT/CS/CE/SE/ME/EE/EB/EC/EI/FT 1401 ENGINEERING MATHEMATICS III
(*2012 Scheme*)

Time : 3 Hours

Maximum Marks : 100

PART A
(Answer *ALL* questions)

$(8 \times 5 = 40)$

I. (a) $f(z) = z^n, n$ any positive integer, show that $f(z)$ is analytic and hence find its derivative.

(b) Show that the transformation $w = z^2$ maps the circle $|z-1| = 1$ into the cardioid $\rho = 2(1+\cos\phi)$.

(c) Find the poles and residues of $f(z) = \dfrac{z^2+z+1}{(z-1)^2(z+2)}$.

(d) Evaluate $\int_c \tan z dz$, c is the circle $|z| = 2$.

(e) Form the partial differential equation by eliminating the function $f\left(x+y+z, x^2+y^2+z^2\right) = 0$.

(f) Solve the partial differential equation $y^2 p - xyq = x(z-2y)$.

(g) Derive one dimensional heat equation.

(h) Using method of separation of variables solve $\dfrac{\partial u}{\partial x} = 2\dfrac{\partial u}{\partial t} + u$, $u(x,0) = 6e^{-3x}$.

PART B

$(4 \times 15 = 60)$

II. (a) If $f(z)$ is analytic show that $\left(\dfrac{\partial^2}{\partial x^2} + \dfrac{\partial^2}{\partial y^2}\right)\log|f(z)| = 0$ (7)

(b) Show that $V = e^x(x\cos y - y\sin y)$ is harmonic function. Find the analytic function $f(z)$ for which V is the imaginary part. (8)

OR

III. (a) Find the image of the region bounded by the lines $x - y < z$ and $x + y > z$ under the mapping $w = 1/z$. (6)

(b) Find the bilinear transformation which maps the points $z = \infty, i, o$ onto $w = o, i, \infty$. (4)

(c) Explain the transformation $w = \sin z$. (5)

(P.T.O.)

IV. (a) Evaluate $\int_c \frac{z}{z^2-1}dz$, where c is (9)

(i) $|z| = 1/2$

(ii) $|z-1| = 1/2$

(iii) $|z| = 2$

(b) Evaluate $\int_0^{2\pi} \frac{d\theta}{(5-3\cos\theta)^2}$ using contour integration. (6)

OR

V. (a) Expand $f(z) = \frac{1}{(z-1)(z-2)}$ as Laurent's series in (9)

(i) $|z| < 1$

(ii) $1 < |z| < 2$

(iii) $0 < |z-1| < 1$

(b) Evaluate $\int_{-\infty}^{\infty} \frac{x^2 dx}{(x^2+1)(x^2+4)}$ using contour integration. (6)

VI. Solve (3x5=15)

(i) $x(y^2-z^2)p - y(z^2+x^2)q = z(x^2+y^2)$

(ii) $p^2 + q^2 = x + y$

(iii) $z = \frac{1}{p} + \frac{1}{q}$

OR

VII. Solve (3x5=15)

(i) $(D^3 - 2D^2D')z = e^{2x+y}$

(ii) $\left(D^3 - 4D^2D' + 4DD'^2\right)z = \sin(3x+2y)$

(iii) $x^2p^2 + y^2q^2 = z^2$

VIII. (a) Derive D-Alembert's solution of one dimensional wave equation. (5)

(b) A string is stretched and fastened to two points l apart. Motion is started by displacing the string in the form $y = a\sin\left(\frac{\pi x}{l}\right)$ from which it is released at time $t = 0$. Show that the displacement of any point at a distance x from one end at time t is given by $y(x,t) = a\sin\left(\frac{\pi x}{l}\right)\cos\left(\frac{\pi ct}{l}\right)$ (10)

OR

IX. (a) Obtain the solution of 2 dimensional Laplace equation. (5)

(b) An insulated rod of length l has its ends A and B maintained at 0°C and 100°C respectively until steady state conditions prevail. If B suddenly reduced to 0°C and maintained at 0°C, find the temperature at a distance x from A at time t. (10)

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BTS – IV– 04.14 –0081

C

B.Tech. Degree IV Semester Examination April 2014

ME 1402 METROLOGY AND INSTRUMENTATION

(2012 Scheme)

Time : 3 Hours Maximum Marks : 100

PART A

(Answer *ALL* questions)

(8 × 5 = 40)

I. (a) Differentiate between tolerance and allowance.

(b) Differentiate between line standard and end standard of measurement.

(c) Explain the working principle of interferometer.

(d) What you mean by lay? Give the symbols of different types of lay on surface.

(e) What are the main functional elements of an instrument? Mention the function of each element.

(f) Write down the generalized mathematical model for a measuring system. Then write down the input output relation for zero order and first order instrument.

(g) What are the different classifications of strain gauge?

(h) Explain gauge factor.

PART B

(4 × 15 = 60)

II. What are the different classifications of fit? Distinguish between hole basis and shaft basis system. (15)

OR

III. Write notes on
(a) Guage maker's tolerance (6)
(b) Guage allowance (3)
(c) Guage materials (6)

IV. Explain the uses of sine bar with a neat sketch. (15)

OR

V. Explain the working of the following instruments with a neat sketch.
(a) Auto collimator (8)
(b) Clinometer (7)

VI. What are the different methods of correction for interfering and modifying inputs? Explain with examples. (15)

OR

VII. (a) Describe how a liquid filled thermometer can be mathematically modelled as a first order system. Find expressions for static sensitivity and time constant. (9)

(b) Define the following terms
(i) Speed of response (3)
(ii) Fidelity and dynamic error (3)

VIII. Explain the methods used for temperature compensation in strain guage. (15)

OR

IX. With a neat sketch, explain the working of
(a) ORSAT apparatus (8)
(b) Gieger Muller Counter (7)

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BTS – IV – 04.14 – 0099

A

B.Tech. Degree IV Semester Examination April 2014

ME 1403 MECHATRONICS

(2012 Scheme)

(Provide regular and semi-log graph sheets in the examination hall)

Time : 3 Hours

Maximum Marks : 100

PART A

(Answer *ALL* questions)

(8 × 5 = 40)

I. (a) Discuss the working of LVDT using neat sketches. Also discuss the utility of LVDT in pressure sensing applications.

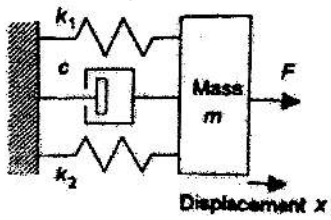
(b) Discuss the applicability of linear and thresholding type hall effect sensors in position sensing and proximity sensing. Also discuss their voltage output characteristics with respect to flux density (distance).

(c) Determine the range of K of a unity feedback system whose open loop transfer function is given by $G(s)=\dfrac{K}{(s+2)(s+4)(s^2+6s+5)}$.

(d) Discuss on half step operation of a stepper motor.

(e) List the basic elements of a thermal system and discuss the effect of each element.

(f) Define transfer function and also determine the transfer function of the system shown in the figure given below.



(g) Using NAND gate construct OR gate.

(h) Elucidate on automatic controls and real time systems.

PART B

(4 × 15 = 60)

II. (a) Draw the JIC symbol for (i) Pumps, (ii) Motors and (iii) Cylinders. (6)

(b) A heating and cooling arrangement is provided to regulate the room temperature. Requirement is to switch on the cooler and switch off the heater (if in operation) when the temperature inside the room rise beyond the set temperature of 30°C. Similarly it is required to switch off the cooler (if in operation) and switch on the heater if the temperature drops below the set temperature of 15°C. Suggest a closed loop control for the above system using block diagram. Assume appropriate set of sensors or other data if required to design it. (9)

OR

III. (a) A switch is to be operated on and off for a specified time duration. Suggest a mechanical system for achieving the above objective. (6)

(b) A potentiometer is used for detecting the linear displacement of a table. This is achieved by connecting a rack in the table and a pinion in the potentiometer knob. 180° rotation of the pinion is equal to 5cm motion of the rack. The resistance of the potentiometer is to vary between 500Ω to 1000Ω for the above movement of zero to 5cm. It is known that the table has moved from its initial position zero to 3.645cm. What will be the corresponding resistance in the potentiometer accurate up to 3 decimal places and what will be the corresponding angular position of the knob of the potentiometer with respect to initial position? (9)

(P.T.O.)

IV. (a) Elucidate PID controllers and sketch its input/output characteristics. Also determine the transfer function of the controller. (8)

(b) List the different methods for tuning of PID controllers and explain any one method in detail. (7)

OR

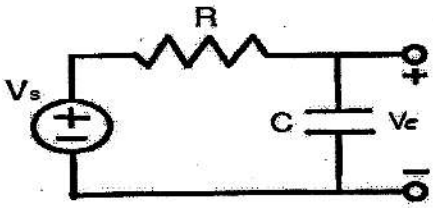
V. An electrical transducer system consists of a RC circuit connected to a supply source V_s as shown in the figure. Assume the values of R and C as 100Ω and 1mF respectively. Determine: (15)

(i) Natural response of the system

(ii) Forced response of the system when a step input of size V is applied.

(iii) Net output voltage V_c across the capacitor when a step input voltage of size 1 volt is applied.

Also draw the time response curve for this system.



VI. A robot arm has a joint control open loop transfer function $G(s)=\dfrac{5(1+2S)}{(1+4S)(1+0.25S)}$. (15)

Plot the frequency response (magnitude and phase). Obtain the gain cross over frequency.

OR

VII. Sketch the root locus for $G(s)=\dfrac{K}{s(s+2)(s+4)}$. Determine the value of K so that the damping ratio of the closed loop system is 0.5. (15)

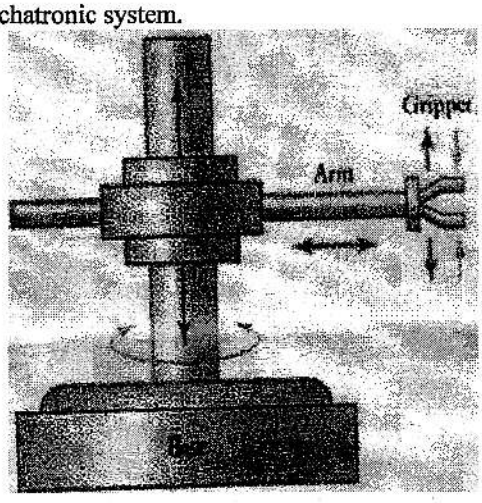
VIII. (a) Discuss the basic architecture of a micro-processor with neat sketches. (8)

(b) Imagine a physician prescribing two drugs. For some conditions drug A is prescribed and for other conditions drug B is prescribed. Taken separately each drug is safe. When used together dangerous side effects are produced. Prepare the Truth Table and suggest a logic gate which suite the above condition. (7)

OR

IX. (a) Discuss the stages involved in designing a mechatronic system. (6)

(b) A pick and place robot as shown in the figure is actuated using 4 pneumatic cylinders. Rotary motion about the base is achieved by using a rack and a pinion arrangement which is used in conjugation with pneumatic cylinder. The other motions are easily achieved by direct actuations of the respective cylinders in the required direction of motion. These cylinders are actuated by solenoid controlled 4 port 3 position direction control valves. Design an appropriate mechatronic system for the above arrangement. (9)



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BTS –IV– 04.14. 0116

B

B.Tech. Degree IV Semester Examination April 2014

ME 1404 APPLIED THERMODYNAMICS
(2012 Scheme)

Time : 3 Hours

Maximum Marks : 100

PART A
(Answer *ALL* questions)

(8 x 5 = 40)

I. (a) What are Helmholtz function and Gibbs function? How are these functions related to availability analysis?

(b) Explain the first law of thermodynamics for closed system and for a cyclic process. What are the limitations of first law?

(c) Explain the process of formation of steam at 1atm from –10°C to 260°C using a T-S diagram.

(d) Write a note on binary vapour cycle, with neat sketches.

(e) Why are supersonic nozzles convergent-divergent?

(f) Describe velocity compounding of impulse turbines.

(g) Explain Dalton's law of partial pressure.

(h) Adiabatic mixing of two fluids are irreversible. Justify.

PART B

(4 x 15 = 60)

II. (a) Derive the Maxwell equations from fundamentals. (10)

(b) Derive the first and second Tds equation. (5)

OR

III. (a) Show that the inequality of Claussius is valid for all possible cycles. (7)

(b) Define and explain Carnot theorem. Show that the efficiency of a reversible engine is independent of the nature or amount of the working substance undergoing the cycle. (8)

IV. In a single heater regenerative cycle the steam enters the turbine at 30 bar, 400°C and the exhaust pressure is 0.1 bar. The feed water heater is a direct contact type which operates at 5 bar. Find (i) The efficiency and steam rate of the cycle (ii) The increase in mean temperature of heat addition, efficiency and steam rate as compared to the Rankine cycle (without regeneration). Neglect pump work. (15)

OR

V. (a) A boiler generates 45×10^3 kg/hr of wet steam at 10 bar pressure and .95 dryness fraction. The boiler receives water at 40°C and the local coal burns in the furnace at the rate of 5×10^3 kg/hr . Calculate the equivalent evaporation of boiler per kg of coal burnt. (8)

(b) Explain the working Lamont boiler, with a neat sketch. (7)

(P.T.O.)

VI. Steam at a pressure of 7 bar and 180°C is discharged through a convergent-divergent nozzle at 1 bar. The mass flow rate of steam is estimated to 2 kg/s. The pressure at the nozzle throat is 4 bar and the steam enters the nozzle with velocity of 75 m/s expansion upto nozzle throat is isentropic and the frictional resistance equivalent to 60 kJ/kg of steam reheats the steam in the divergent section. Make calculations for: (15)

(i) Suitable areas for the throat and exit

(ii) Overall efficiency of nozzle based on enthalpy drop between the actual state of steam and the back pressure.

OR

VII. The velocity of steam at inlet to a single row impulse turbine is 400m/s and the nozzle angle is 20°. The mean blade speed is 150 m/s and the axial thrust on the blade is estimated to be zero. Make calculations for: (15)

(i) Inlet and outlet angles of moving blades

(ii) Power developed for a steam flow rate of 1.5kg/s

(iii) Magnitude and direction of velocity f steam at exit

Neglect the effect of friction when passing through blade passages and obtain your solution from the geometry of velocity diagrams.

VIII. Two vessels are connected by a valve. One vessel contains 0.6kg mole of nitrogen gas at 50°C and 15 bar pressure. The other vessel holds 3.5kg of the same gas at 25°C and 6.5 bar. The valve is opened and the gases are allowed to mix while having heat interaction with the surroundings. If the final equilibrium temperature is 30°C, (15)

(i) Calculate the final equilibrium pressure and the amount of heat transferred to the surroundings

(ii) Considering the vessels to be perfectly insulated, find the final temperature and pressure, which would have been reached. Take adiabatic exponent $\Upsilon = 1.4$.

OR

IX. A mixture of ideal gases consist of 3kg of nitrogen and 5kg of carbon dioxide at a pressure of 300kPa and a temperature of 20°C. Find (i) The mole fraction of each constituent (ii) The equivalent molecular weight of the mixture (iii) The equivalent gas constant of the mixture (iv) The partial pressures and the partial volumes (v) The volume and density of the mixture (vi) The C_p and C_v of the mixture. (15)

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BTS –IV– 04.14.0132

C

B.Tech. Degree IV Semester Examination April 2014

ME 1405 HYDRAULIC MACHINERY

(*2012 Scheme*)

Time : 3 Hours Maximum Marks : 100

PART A

(Answer *ALL* questions)

(8 x 5 = 40)

I. (a) State Buckingham's pi-theorem.

(b) A blade turns the jet of diameter 3cm at a velocity of 20m/s by 60°. Determine the force exerted by the blade on the fluid.

(c) Name and briefly describe the differences between the two basic types of dynamic turbine.

(d) What is a draft tube and what is its purpose? Describe what would happen if turbomachinery designers did not pay attention to the design of the draft tube.

(e) What is cavitation in centrifugal pumps?

(f) What are the advantages of installing air vessels in reciprocating pumps?

(g) Explain the working of a vane pump with neat sketch.

(h) Write short note on hydraulic ram.

PART B

(4 x 15 = 60)

II. Derive on the basis of dimensional analysis suitable parameters to present the thrust developed by a property. Assume that the thrust P depends upon the angular velocity ω, speed of advance V, diameter D, dynamic viscosity μ, mass density ρ, elasticity of the fluid medium which can be denoted by speed of sound C in the medium. (15)

OR

III. A water jet 20mm in diameter and having a velocity of 90m/s strikes series of moving blades in a wheel. The direction of the jet makes 20° with the direction of movement of the blade. The blade angle at inlet is 35°. If the jet should enter the blade without striking, what should be the blade velocity? If the outlet angle of the blade is 30°, determine the force on the blade. Assume that there is no friction involved in the flow over the blade. (15)

IV. A pelton turbine is required to develop 9000 KW when working under a head of 300m the impeller may rotate at 500rpm. Assuming a jet ratio of 10 and an overall efficiency of 85%, calculate. (15)

(i) Quantity of water required
(ii) Diameter of the wheel
(iii) Number of jets
(iv) Number and size of the bucket vanes on the runner

OR

(P.T.O.)

V. (a) Derive the expression for specific speed of a turbine. (7)

(b) A reaction turbine working under a head of 100m and at a speed of 700rpm has an overall efficiency of 80%. If the specific speed is 175, calculate the discharge. What would be required if the head is reduced to 80m? (8)

VI. (a) A centrifugal pump is discharged $118m^3/sec$ at a speed of 1450rpm against a head of 25m. The impeller diameter is 25cm, its width at outlet is 5cm and the manometric efficiency is 0.75. Determine the vane angle at the outer periphery of the impeller. (8)

(b) Write a short note on multistage centrifugal pump. (7)

OR

VII. (a) Explain the function of air vessels fitted to a reciprocating pump. (9)

(b) A single acting reciprocating pump has a plunger of diameter 50cm and a stroke of 80cm. If the speed of the pump is 60rpm and coefficient of discharge is 0.97, determine the actual discharge and the percentage slip of the pump. (6)

VIII. Explain construction and working of hydraulic torque convertor with neat sketch, (15)

OR

IX. Write short notes on: (15)

(i) Hydraulic accumulator

(ii) Hydraulic intensifier

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BTS – I V– 04.14 –0147

B

B.Tech. Degree IV Semester Examination April 2014

ME 1406 MANUFACTURING PROCESS
(2012 Scheme)

Time : 3 Hours Maximum Marks : 100

PART A
(Answer *ALL* questions)

(8 × 5 = 40)

I. (a) Explain advantages and limitations of metal casting process.

(b) Write notes on (i) gating ratio (ii) risering design

(c) Describe centrifugal casting.

(d) Describe die casting.

(e) Write notes on different types of sheet metal operations.

(f) Explain different types of forging operations.

(g) Briefly describe advantages of electrode coating in arc welding.

(h) Explain thermit welding process.

PART B

(4 × 15 = 60)

II. Explain pattern allowances, with the help of neat sketches.

OR

III. Explain the preparation of moulding sand. What are the desirable properties of mouldig sand?

IV. Explain shell moulding. Describe the process in detail.

OR

V. Explain any four types of casting defects.

VI. Narrate the process of direct extrusion. Describe how a hollow profile is extruded, with the help of a neat sketch.

OR

VII. Describe rolling process in detail. What is roll passes?

VIII. Write notes on different types of resistance welding.

OR

IX. Write notes on
(i) Laser beam welding
(ii) Diffusion welding
(iii) Electro slag welding

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