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15MAT31

# Third Semester B.E. Degree Examination, June/July 2017
## Engineering Mathematics - III

Time: 3 hrs. Max. Marks: 80

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

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.

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### Module-1

1 a. Obtain the Fourier series expansion of

$$f(x) = \begin{cases} \pi x & 0 \le x \le 1 \\ \pi(2-x) & 1 \le x \le 2 \end{cases}$$ **(08 Marks)**

and deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots = \frac{\pi^2}{8}$.

b. Obtain the constant term and first sine and cosine terms in the Fourier expansion of y from the following table. **(08 Marks)**

| x | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| y | 9 | 18 | 24 | 28 | 26 | 20 |

**OR**

2 a. Expand $f(x) = |x|$ as a Fourier series in $-\pi \le x \le \pi$ and deduce that **(06 Marks)**

$$\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots = \frac{\pi^2}{8}.$$

b. Obtain the half range cosine series for the function $f(x) = x \sin x$ in $0 < x < \pi$. **(05 Marks)**

c. The following table gives variations of periodic current over a period T. Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of first harmonic. **(05 Marks)**

| t(sec) | 0 | $\frac{T}{6}$ | $\frac{T}{3}$ | $\frac{T}{2}$ | $\frac{2T}{3}$ | $\frac{5T}{6}$ |
|---|---|---|---|---|---|---|
| A (amp) | 1.98 | 1.3 | 1.05 | 1.3 | -0.88 | -0.25 |

### Module-2

3 a. Find the Fourier Transform of

$$f(x) = \begin{cases} 1 - x^2 & |x| \le 1 \\ 0 & |x| > 1 \end{cases}$$ **(06 Marks)**

Hence evaluate $\int_0^\infty \frac{x\cos x - \sin x}{x^3} \cos \frac{x}{2}\, dx$.

b. Find the Fourier cosine transform of

$$f(x) = \begin{cases} x & \text{for } 0 < x < 1 \\ 2 - x & \text{for } 1 < x < 2 \\ 0 & \text{for } x > 2 \end{cases}$$ **(05 Marks)**

c. Find the inverse Z – transform of

$$\frac{3z^2 + 2z}{(5z-1)(5z+2)}.$$ **(05 Marks)**

**OR**

4 a. Find the Fourier sine transform of $\frac{e^{-ax}}{x}$, $a > 0$. **(06 Marks)**

b. Find the Z – transform of i) $\cosh n\theta$ ii) $n^2$. **(05 Marks)**

c. Solve the difference equation $y_{n+2} + 4y_{n+1} + 3y_n = 3^n$ with $y_0 = 0$, $y_1 = 1$. **(05 Marks)**

## Module-3

5 a. Find the coefficient of correlation and two regression lines for the following data : **(06 Marks)**

| x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| y | 10 | 12 | 16 | 28 | 25 | 36 | 41 | 49 | 40 | 50 |

b. Fit a curve of the form $y = ae^{bx}$ for the following data : **(05 Marks)**

| x | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|
| y | 133 | 55 | 23 | 7 | 2 | 2 |

c. Use Newton – Raphson method to find a real root of the equation $x \sin x + \cos x = 0$ near $x = \pi$. **(05 Marks)**

**OR**

6 a. In a partially destroyed lab record, only the lines of regression of y on x and x on y are available as $4x - 5y + 33 = 0$ and $20x - 9y = 107$ respectively. Calculate $\bar{x}$, $\bar{y}$ and coefficient of correlation between x and y. **(06 Marks)**

b. Fit a second degree parabola to the following data : **(05 Marks)**

| x | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 |
|---|---|---|---|---|---|---|---|
| y | 1.1 | 1.3 | 1.6 | 2.0 | 2.7 | 3.4 | 4.1 |

c. Use the regula – falsi method to obtain a root of the equation $2x - \log_{10}x = 7$ which lies between 3.5 and 4. Carryout 2 iterations. **(05 Marks)**

## Module-4

7 a. The population of a town is given by the table **(06 Marks)**

| Year | 1951 | 1961 | 1971 | 1981 | 1991 |
|---|---|---|---|---|---|
| Population in thousands | 19.96 | 39.65 | 58.81 | 77.21 | 94.61 |

Using Newton's forward and backward interpolation formula, calculate the increase in the population from the year 1955 to 1985.

b. Use Lagrange's interpolation formula to find y at x = 10, given **(05 Marks)**

| x | 5 | 6 | 9 | 11 |
|---|---|---|---|---|
| y | 12 | 13 | 14 | 16 |

c. Given the values

| x | 2 | 4 | 5 | 6 | 8 | 10 |
|---|---|---|---|---|---|---|
| y | 10 | 96 | 196 | 350 | 868 | 1746 |

Construct the interpolating polynomial using Newton's divided difference interpolation formula. **(05 Marks)**

**OR**

8 a. From the following table, estimate the number of students who obtained marks between 40 and 45. **(06 Marks)**

| Marks | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 |
|---|---|---|---|---|---|
| No. of students | 31 | 42 | 51 | 35 | 31 |

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b. Apply Lagrange's formula inversely to obtain the root of the equation $f(x) = 0$, given $f(30) = -30$, $f(34) = -13$, $f(38) = 3$, $f(42) = 18$. **(05 Marks)**

c. Use Simpson's $\frac{1}{3}$ rule to find $\int_0^{0.6} e^{-x^2} dy$ by taking 7 ordinates. **(05 Marks)**

## Module-5

9 a. Find the work done in moving a particle in the force field $\vec{F} = 3x^2 i + (2xz - y)j + z k$ along the curve defined by $x^2 = 4y$, $3x^3 = 8z$ from $x = 0$ to $x = 2$. **(06 Marks)**

b. Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)i - 2xy j$ around the rectangle $x = \pm a$, $y = 0$, $y = b$. **(05 Marks)**

c. Solve the Euler's equation for the functional $\int_{x_0}^{x_1} (1 + x^2 y^1) y^1 dx$. **(05 Marks)**

**OR**

10 a. Verify Green's theorem for $\int_c (xy + y^2)dx + x^2 dy$, where c is bounded by $y = x$ and $y = x^2$. **(06 Marks)**

b. Evaluate the surface integral $\iint_s \vec{F} . Nds$ where $\vec{F} = 4xi - 2y^2 j + z^2 k$ and s is the surface bounding the region $x^2 + y^2 = 4$, $z = 0$ and $z = 3$. **(05 Marks)**

c. Show that the shortest distance between any two points in a plane is a straight line. **(05 Marks)**

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15ME32

# Third Semester B.E. Degree Examination, June/July 2017
## Material Science

Time: 3 hrs. Max. Marks: 80

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

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-1

1 a. With the help of Stress – strain diagrams, briefly explain the ductile and brittle behaviour of Engineering Materials. **(08 Marks)**

b. A 0.2% e steel component is to be carburized at 920$^0$C. Calculate the time required to increase the carbon content at 0.5mm below the surface to 0.4%.
D920$^0$C = 1.28 × 10$^{-11}$ m$^2$/S. Carbon content is 0.9% at the surface. **(08 Marks)**

| Z | 0.75 | 0.80 | 0.85 |
|---|---|---|---|
| erf Z | 0.7112 | 0.7421 | 0.7707 |

**OR**

2 a. With a neat creep curve, explain different stages of creep deformation. **(08 Marks)**

b. Explain the mechanisms of fatigue failure in engineering materials with necessary diagram. **(08 Marks)**

### Module-2

3 a. What is meant by Homogeneous nucleation? Derive an expression for critical radius required for homogeneous nucleation, with free energy curve. **(08 Marks)**

b. Explain Substitutional and Interstitial solid solutions. Discuss Hume – Rothary rules governing formation of solid solutions. **(08 Marks)**

**OR**

4 a. Draw a neat Iron – Carbon equilibrium phase diagram and label all phases, regions and invariant phase. **(08 Marks)**

b. Two metals A & B are completely soluble in liquid and partially soluble in solid state. Draw their phase diagram for following details.
i) Solid solubility of B in A is 5% at 600$^0$C and 0$^0$C.
ii) Solid solubility of A in B is 10% at 600$^0$C and 0$^0$C.
iii) Eutectic is formed at 60% B.
Also find the liquid and solid phase percentages in an alloy with 20% B at 650$^0$C. **(08 Marks)**

### Module-3

5 a. Draw a neat labeled TTT diagram for eutectoid steel. Show a cooling curve for the formation of 100% marten site on it and explain the curve. **(08 Marks)**

b. Differentiate clearly between Normalizing and Annealing. Discuss Spheroidising Annealing with applications. **(08 Marks)**

**OR**

6 a. With a neat diagram, explain induction hardening process. Discuss the advantages, limitations and applications of the process. **(08 Marks)**

b. Discuss on various types of cast irons with necessary micro structures. **(08 Marks)**

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## Module-4

7 a. Differentiate between Thermo settling and Thermoplastic polymers. What are the advantages and disadvantages of plastic materials? **(08 Marks)**

b. What is meant by Residual Life Accessment? Explain the Nondestructive testing methods useful for Accessing residual life of materials. **(08 Marks)**

**OR**

8 a. Describe Shape memory alloys. Explain briefly the applications of shape memory alloys. **(08 Marks)**

b. Classify Ceramic materials. Explain the application and processing method of any one class. **(08 Marks)**

## Module-5

9 a. Classify the composite materials on matrix and reinforcement. List the roles of matrix, reinforcement and interface. **(08 Marks)**

b. For a directionally oriented fiber – reinforced composite, the Young's modulus in iso - strain and iso – stress condition are 33.1 GPa and 3.66 GPa respectively. For a fiber volume fraction of 0.30, determine the Yong's modules for fiber and matrix phases. **(08 Marks)**

**OR**

10 a. With a neat figure, explain Injection moulding process for particulate reinforced polymers. **(08 Marks)**

b. List the advantages and limitations of composite materials. Mention any four applications of polymer matrix composites. **(08 Marks)**

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15ME33

# Third Semester B.E. Degree Examination, June/July 2017
## Basic Thermodynamics

Time: 3 hrs. Max. Marks: 80

**Note:** 1. *Answer FIVE full questions, choosing one full question from each module.*
2. *Use of thermodynamic data hand book is permitted.*

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-1

1 a. Distinguish between:
(i) Open system and isolated system
(ii) Intensive property and extensive property.
(iii) Cyclic process and non-cyclic process **(06 Marks)**

b. State zeroth law of thermodynamics and define equality of temperature. **(04 Marks)**

c. The temperature 't' on a linear Celcius scale is related to thermometric property 'X' by the relation, $t = A.\log_e X + B$, where A and B are constants. The value of X was found to be 1.47 and 5.2 at the ice point and steam point which are assigned the numbers 0 and 100 respectively on Celcius scale. Determine the temperature 't' corresponding to a reading of X equal to 2.65. **(06 Marks)**

**OR**

2 a. Define work from thermodynamic point of view. **(02 Marks)**

b. Derive an expression for the non-flow displacement work done during adiabatic process given by $PV^{\gamma} = C$, where $\gamma = \frac{C_P}{C_V}$. **(06 Marks)**

c. A closed system undergoes two processes one after the other – constant pressure process at a pressure of 5 bar from initial volume of 0.03 $m^3$ to 0.09 $m^3$. It is followed by polytropic expansion process according to $PV^{1.3} = C$ from 0.09 $m^3$ volume to 0.2 $m^3$ final volume. Sketch the two processes on PV diagram and find
(i) Final pressure after expansion.
(ii) Work done during each process and net work done. **(08 Marks)**

### Module-2

3 a. State the I law of thermodynamics for a cyclic process. Obtain an expression for the I law of thermodynamics for a closed system undergoing change of state and prove that internal energy is a property. **(10 Marks)**

b. A steam turbine operating under steady flow conditions receives steam at a steady rate of 0.5 kg/s. Conditions of steam at turbine inlet are specific enthalpy $h_1$ = 2800 kJ/kg, velocity $C_1$ = 30 m/s, elevation $Z_1$ = 4 m. The conditions at the turbine outlet are specific enthalpy $h_2$ = 2380 kJ/kg, Velocity $C_2$ = 105 m/s and elevation $z_2$ = 1 m. Heat loss to the surroundings is 0.4 KJ/s. Using steady flow energy equation, determine power output of the turbine in kW. **(06 Marks)**

**OR**

4 a. State the limitations of I law of thermodynamics. **(02 Marks)**

b. State the Kelvin-Planck and Clausius statements of II law of thermodynamics. Show that Kelvin-Planck statement is equivalent to Clausius statement. **(08 Marks)**

c. A Carnot heat engine operates between source temperature of $T_1$K and sink temperature of $T_2$K. Difference between the source and sink temperature is 240. If the work developed by the Carnot engine is 0.74 times the heat rejected by the Carnot engine to the sink, find the efficiency of the Carnot engine and also source temperature and sink temperature. **(06 Marks)**



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## Module-3

5 a. Define reversible process and list any four factors that make a process irreversible. Explain any one factor. **(06 Marks)**

b. Prove that 'No heat engine is more efficient than a reversible heat engine, when both engines operate in cycle between same temperatures limits $T_1$ and $T_2$ with $T_1 > T_2$. **(06 Marks)**

c. Two reversible engines A and B working on Carnot cycle operate in series such that engine A receives heat from source maintained at 600 K and rejects heat to an intermediate sink maintained at $T_I$. Engine B receives heat rejected by engine A through intermediate sink and rejects heat to a sink maintained at 300 K. If both the engines have same efficiency, determine the temperature $T_I$ of the intermediate sink. **(04 Marks)**

**OR**

6 a. State and prove Clausius inequality. **(06 Marks)**

b. Starting from I law show that for a reversible constant pressure process $(s_2 - s_1) = C_p \log_e\left(\frac{T_2}{T_1}\right)$. **(04 Marks)**

c. 1.5 kg of air is heated reversibly at constant pressure from 300 K to 600 K and is then cooled reversibly at constant volume back to initial temperature of 300 K. If initial pressure is 1 bar, calculate the entropy change during each process and net change in entropy. Sketch the processes on T-S diagram. Take $C_P = 1.005$ KJ/kgK and $C_V = 0.718$ KJ/kgK. **(06 Marks)**

## Module-4

7 a. Define the following: (i) Available energy (ii) Unavailable energy (iii) Effectiveness (iv) Irreversibility. **(08 Marks)**

b. A system at 800 K receives heat at the rate of 4000 KJ/min from a reservoir at 1200 K. The temperature of the surrounding (sink) is 300 K. Assuming that the temperature of the source and the system remain constant during heat transfer, obtain (i) the net change of entropy during heat transfer (ii) The decrease in available energy after heat transfer. **(08 Marks)**

**OR**

8 a. Define (i) Pure substance (ii) Dryness fraction. **(03 Marks)**

b. Explain with a neat sketch the working of a throttling calorimeter to determine the dryness fraction of wet steam. **(07 Marks)**

c. Superheated steam from an initial condition of 5 bar and 300°C is expanded isentropically to a pressure of 0.5 bar. Calculate : (i) Final condition of steam after expansion. (ii) Change in enthalpy / kg of steam (iii) Change in internal energy / kg of steam. **(06 Marks)**

## Module-5

9 a. Define as applied to ideal gas mixtures: (i) Mole fraction (ii) Dalton's law of partial pressures. (iii) Relative humidity.(iv) Due point temperature. **(08 Marks)**

b. A mixture of ideal gases contain 5 kg of $N_2$ and 8 kg of $CO_2$. The partial pressure of $N_2$ in the mixture is 120 KPa. Find (i) Mole fraction of $N_2$ and $CO_2$ (ii) Partial pressure of $CO_2$. (iii) Molecular weight of the mixture. **(08 Marks)**

**OR**

10 a. Write a brief note on: (i) Reduced properties. (ii) Law of corresponding states. **(04 Marks)**

b. Derive an expression for the Vander Waal's constants 'a' and 'b' in terms of critical properties. **(06 Marks)**

c. 1 kg of $CO_2$ has a volume of 0.86 $m^3$ at 120°C. Compute the pressure using

(i) Ideal gas equation.

(ii) Vander Waal's equation.

Take Vander Waal's constants for $CO_2$

$a = 365.6 \frac{KNm^4}{(kgmole)^2}$ and $b = 0.0423 \frac{m^3}{kgmole}$ **(06 Marks)**

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15ME/MA34

# Third Semester B.E. Degree Examination, June/July 2017
## Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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### Module-1

1 a. Define the following: (i) Elasticity (ii) Ductility (iii) Toughness (iv) Hardness (v) Stiffness (vi) Resilience **(06 Marks)**

b. The tensile test was conducted on a mild steel bar. The following data was obtained from the test. Diameter of the steel bar = 16 mm; Gauge length of the bar = 80 mm; Load at proportionality limit = 72 kN; Extension at a load of 60 kN = 0.115 mm; Load at failure = 80 kN; Final Gauge length of bar = 104 mm; Diameter of the rod at failure = 12 mm. Determine : (i) Young's modulus (ii) Proportionality limit. (iii) True breaking stress (iv) Percentage elongation. **(10 Marks)**

**OR**

2 a. Derive a relation between modulus of elasticity and bulk modulus. **(06 Marks)**

b. At room temperature, the gap between bar A and bar B shown in Fig. Q2 (b) is 0.25 mm. What are the stresses induced in the bars, if the temperature rise is 35°C. Given, $A_A = 1000\ mm^2$ ; $A_B = 800\ mm^2$; $E_A = 2\times10^5$ N/mm$^2$; $E_B = 1\times10^5$ N/mm$^2$; $\alpha_A = 12\times10^{-6}/^\circ C$; $\alpha_B = 23\times10^{-6}/^\circ C$; $L_A = 400$ mm; $L_B = 300$mm **(10 Marks)**

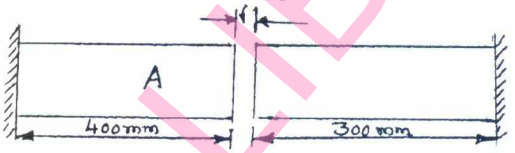


Fig. Q2 (b)

### Module-2

3 a. A point in a strained material is subjected to a tensile stress of 500 N/mm$^2$ and 300 N/mm$^2$ in two mutual perpendicular planes. Calculate the normal, tangential, resultant stresses and its obliguity on a plane making an angle of 30° with the axis of second stress. Also find the maximum shear stress. **(10 Marks)**

b. A thick cylindrical shell of 160 mm internal diameter is subjected to an internal pressure of 8 N/mm$^2$. Find the thickness of shell if the permissible or hoop stress in the section is not to exceed 35 N/mm$^2$. **(06 Marks)**

**OR**

4 a. An elemental cube is subjected to tensile stresses of 30 N/mm$^2$ and 10 N/mm$^2$ acting on two mutually perpendicular planes and a shear stress of 10 N/mm$^2$ on these planes. Draw the Mohr's circle of stresses and hence determine the magnitudes and directions of principal stresses and also the greatest shear stress. **(08 Marks)**

b. A thin cylindrical shell with following dimensions is filled with a liquid at atmospheric pressure : Length = 1.2 m, External diameter = 200 mm, Thickness of metal = 8 mm. Find the value of the pressure exerted by the liquid on the walls of the cylinder and the hoop stress induced if an additional volume of 25000 mm$^3$ of liquid is pumped into the cylinder. Take $E = 2.1\times10^5$ N/mm$^2$ and $\mu = 0.33$. **(08 Marks)**

## Module-3

5 For the beam shown in Fig. Q5. Draw shear force and bending moment diagram. Locate the point of contraflexure if any. **(16 Marks)**

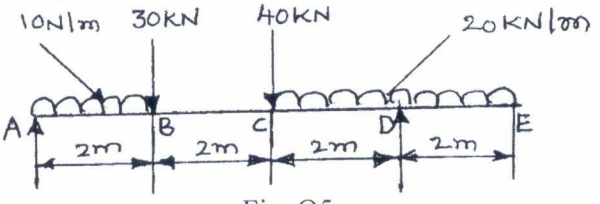


Fig. Q5

**OR**

6 a. Derive a relationship between bending stress and radius of curvature. **(08 Marks)**

b. Derive the deflection equation, $EI\frac{d^2y}{dx^2} = M$. **(08 Marks)**

## Module-4

7 a. State the assumptions made in pure torsion theory. **(04 Marks)**

b. A solid circular shaft has to transmit a power of 1000 kW at 120 rpm, Find the diameter of the shaft, if the shear stress of the material must not exceed 80 N/mm$^2$. The maximum torque 1.25 time of its mean. What percentage of saving in material would be obtained if the shaft is replaced by a hollow one whose internal diameter is 0.6 times its external diameter, the length, material and maximum shear stress being same? **(12 Marks)**

**OR**

8 a. Derive a Euler's crippling load for a column when both of its ends are hinged. **(08 Marks)**

b. A 1.5 m long column has a circular cross section of 50 mm diameter. One end of the column is fixed in direction and position and the other end is free. Taking the factor of safety as 3, calculate the safe load using Euler's formula. Taking $E = 1.2\times10^5$ N/mm$^2$. **(08 Marks)**

## Module-5

9 a. Derive an expression for strain energy due to shear stresses. **(08 Marks)**

b. Write a note on: (i) Maximum principal stress theory. (ii) Maximum shear stress theory. **(08 Marks)**

**OR**

10 a. A hollow circular shaft 2 m long is required to transmit 1000 kW power, when running at a speed of 300 rpm. If the outer diameter of the shaft is 150 mm and inner diameter is 120 mm. Find the maximum shear stress and strain energy stored in the shaft. **(08 Marks)**

b. A solid circular shaft is subjected to a bending moment of 40 kN-m and a torque of 10 kN-m. Design the diameter of the shaft according to, (i) Maximum principal stress theory. (ii) Maximum shear stress theory.
Take $\mu = 0.25$, stress at elastic limit = 200 N/mm$^2$ and factor of safety= 2. **(08 Marks)**

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15ME35A

# Third Semester B.E. Degree Examination, June/July 2017
## Metal Casting and Welding

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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### Module-1

1 a. Explain briefly with an example the term Manufacturing. **(04 Marks)**

b. State the factors which determine the selection of a casting alloy and the casting process to be employed. **(04 Marks)**

c. Define Pattern. List the types and briefly explain Pattern Allowances. **(08 Marks)**

**OR**

2 a. Enumerate the desirable properties of molding sand. **(08 Marks)**

b. Explain with sketch, shell moulding process. **(04 Marks)**

c. Show the Graphical representation of Gating system labeling all its components. **(04 Marks)**

### Module-2

3 a. Classify Melting furnaces. Explain any one of them with neat sketch. **(08 Marks)**

b. Explain the working of Cupola and mark different heat zones clearly. **(08 Marks)**

**OR**

4 a. Differentiate between true centrifugal casting and centrifuge casting with sketches. **(08 Marks)**

b. Describe with a neat sketch, Thixo casting process and mention its advantages, limitations and applications. **(08 Marks)**

### Module-3

5 a. Why is Directional Solidification essential in casting? Explain the methods available to achieve the same with sketches. **(10 Marks)**

b. State the advantages and limitations of casting process. **(06 Marks)**

**OR**

6 a. List the casting defects. List the causes and recommend remedial measures to overcome them. **(08 Marks)**

b. Explain the melting of Aluminium using stir casting setup. **(08 Marks)**

### Module-4

7 a. Define Welding and classify them on the basis of Energy resources. **(04 Marks)**

b. Differentiate between MIG and TIG welding. **(06 Marks)**

c. With a neat sketch, explain the working of Atomic Hydrogen Welding (AHW) process. **(06 Marks)**

**OR**

8 a. With a neat sketch, explain the principle , process of LASER welding and mention its advantages. **(08 Marks)**

b. Explain the following processes with neat sketches :

i) Friction welding ii) Explosive welding. **(08 Marks)**

## Module-5

| | | | |
|---|---|---|---|
| 9 | a. | What is Heat Affected Zone (HAZ)? Enumerate the parameters affecting it. | **(06 Marks)** |
| | b. | What are Welding defects? Explain any five with sketches. | **(08 Marks)** |
| | c. | What are the functions of Electrode coatings? | **(02 Marks)** |

**OR**

| | | | |
|---|---|---|---|
| 10 | a. | Differentiate between Soldering and Brazing process. | **(06 Marks)** |
| | b. | What is NDT? Give broad classification of NDT. | **(04 Marks)** |
| | c. | Explain the following test with respect to welding with neat sketches :<br>i) Holographic Inspection ii) Magnetic Particle Inspection. | **(06 Marks)** |

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15ME35B

# Third Semester B.E. Degree Examination, June/July 2017
## Machine Tools and Operations

Time: 3 hrs. Max. Marks: 80

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

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-1

1 a. Explain with a neat sketch, the main parts of a lathe machine. **(08 Marks)**

b. Sketch and explain radial drilling machine and list the classification of drilling machine. **(08 Marks)**

**OR**

2 a. Draw a neat sketch to show major parts of a horizontal milling machine. **(08 Marks)**

b. Sketch a planning machine indicating major parts. Name any one of the mechanism for quick return movement in a planer. **(08 Marks)**

### Module-2

3 a. What are the different motion provided on a lathe? **(06 Marks)**

b. List and explain different machining parameters and related quantities on a lathe. **(05 Marks)**

c. What are the tools used on lathes? **(05 Marks)**

**OR**

4 a. Explain the process of up-milling and down milling. What are advantages of each process? **(06 Marks)**

b. List and explain different machining parameters and related quantities on a broaching machine. **(05 Marks)**

c. Draw a neat sketch and explain centerless grinding machine. **(05 Marks)**

### Module-3

5 a. Explain the geometry of a single point cutting tool with a neat sketch. **(06 Marks)**

b. List and explain the essential properties of cutting tool materials. **(05 Marks)**

c. Explain the effect of machining parameters on surface finish. **(05 Marks)**

**OR**

6 a. A workpiece of diameter 38 mm and length 400 mm was turned on a lathe using suitable cutting tool. Determine the machining time to reduce the workpiece to 36.5 mm diameter in one pass with cutting speed of 30 mpm and feed 0.7 mm/rev. **(08 Marks)**

b. A shaping machine is used to machine a rectangular piece of 18 cm long and 35 cm width which cutting speed being 26 m/min. Feed is 0.8 mm/cycle cutting stroke is adjusted to 20 cm. Time for cutting to return stroke is 3 : 2. Find the time required for machining the whole surface. **(08 Marks)**

### Module-4

7 a. Briefly explain the different types of chips produced during metal cutting with neat sketches. **(06 Marks)**

b. Draw merchants circle diagram using usual notations and state the assumptions. **(05 Marks)**

c. The following data refer to an orthogonal cutting process. Chip thickness 0.62 mm, feed 0.2 mm, rake angle 15°. Calculate chip reduction co-efficient and shear angle. **(05 Marks)**



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**OR**

8 a. What are the components of cutting force in turning a cylindrical job? **(06 Marks)**

b. Derive an expression for power needed in a turning operation. **(05 Marks)**

c. List the drilling factors affect the drilling torque and thrust force. **(05 Marks)**

## Module-5

9 a. Define tool life. List out the wear mechanisms. Explain any one. **(06 Marks)**

b. A tool life of 80 minute is obtained at a speed of 30 mpm and 8 minute at 60 mpm. Determine the tool life equation and cutting speed for 4 minute tool life. **(05 Marks)**

c. What is machinability? List out the machinability criteria. **(05 Marks)**

**OR**

10 a. What do you understand by economics of machining? How do you evaluate machining cost? **(08 Marks)**

b. Explain how do you evaluate the actual time of machining. **(08 Marks)**

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15ME36B

# Third Semester B.E. Degree Examination, June/July 2017
## Mechanical Measurements and Metrology

Time: 3 hrs. Max. Marks: 80

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

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.

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### Module-1

| | | | |
|---|---|---|---|
| 1 | a. | Brief the need of Inspection. | (04 Marks) |
| | b. | What are the principles of measurements? | (04 Marks) |
| | c. | Explain the process of measurement. | (04 Marks) |
| | d. | What are the causes of Errors in measurements? | (04 Marks) |
| | | **OR** | |
| 2 | a. | Explain the wavelength standard of measurements. | (04 Marks) |
| | b. | What care should be taken in use of slip gauges? | (04 Marks) |
| | c. | What is Sine bar? Explain the principle of sine bar. | (04 Marks) |
| | d. | With a sketch, explain the principle of auto collimator. | (04 Marks) |

### Module-2

| | | | |
|---|---|---|---|
| 3 | a. | Explain the types of fits. | (04 Marks) |
| | b. | What is Hole basis and Shaft basis system? | (04 Marks) |
| | c. | Define the Interchangeability and Selective Assembly. | (04 Marks) |
| | d. | Explain the compound tolerance, with a suitable example. | (04 Marks) |
| | | **OR** | |
| 4 | a. | What are the materials used in gauge manufacturing? | (04 Marks) |
| | b. | List the functional requirements of a comparator. | (04 Marks) |
| | c. | With a neat sketch, explain the optical comparator. | (08 Marks) |

### Module-3

| | | | |
|---|---|---|---|
| 5 | a. | How do you measure the minor diameter of Internal threads? | (04 Marks) |
| | b. | What is "Best Size wire"? Derive the best wire size in terms of pitch and flank angle. | (08 Marks) |
| | c. | With a sketch, show the terminology of a spur gear. | (04 Marks) |
| | | **OR** | |
| 6 | a. | With a neat sketch, explain the gear roll tester for composite error measurement. | (08 Marks) |
| | b. | Explain the basic concept of coordinating measuring machine. | (08 Marks) |

### Module-4

| | | | |
|---|---|---|---|
| 7 | a. | What is the significance of measurements? | (04 Marks) |
| | b. | Explain in detail, the Generalized Measuring System. | (08 Marks) |
| | c. | What is Transfer Efficiency? | (04 Marks) |
| | | **OR** | |

| | | | |
|---|---|---|---|
| 8 | a. | What is Ballast Circuit? | **(04 Marks)** |
| | b. | With a neat sketch, explain the Cathode Ray Oscilloscope. | **(08 Marks)** |
| | c. | What are the advantages of Electrical intermediate modifying devices? | **(04 Marks)** |

## Module-5

| | | | |
|---|---|---|---|
| 9 | a. | With a neat sketch, explain the Hydraulic dynamometer. | **(08 Marks)** |
| | b. | Sketch and explain the working of an Pirani gauge. | **(08 Marks)** |

**OR**

| | | | |
|---|---|---|---|
| 10 | a. | List the strain gauge material and bonding material. | **(04 Marks)** |
| | b. | Write a note on Mounting of Strain gauge. | **(04 Marks)** |
| | c. | With a neat sketch, explain the Optical pyrometer. | **(08 Marks)** |

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15MATDIP31

# Third Semester B.E. Degree Examination, June/July 2017
## Additional Mathematics - I

Time: 3 hrs. Max. Marks: 80

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

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-1

1 a. Express $\frac{3+4i}{3-4i}$ in the form x + iy. **(06 Marks)**

b. Express $\sqrt{3}+i$ in the polar form and hence find their modulus and amplitudes. **(05 Marks)**

c. Find the sine of the angle between $\vec{a} = 2i - 2j + k$ and $\vec{b} = i - 2j + 2k$. **(05 Marks)**

**OR**

2 a. Simplify **(06 Marks)**

$$\frac{(\cos 3\theta + i\sin 3\theta)^4 (\cos 4\theta + i\sin 4\theta)^5}{(\cos 4\theta + i\sin 4\theta)^3 + (\cos 5\theta + i\sin 5\theta)^{-4}}$$

b. If $\vec{a} = i + 2j - 3k$ and $\vec{b} = 3i - j + 2k$, then show that $(\vec{a} + \vec{b})$ and $(\vec{a} - \vec{b})$ are orthogonal. **(05 Marks)**

c. Find the value of $\lambda$, so that the vectors $\vec{a} = 2i - 3j + k$, $\vec{b} = i + 2j - 3k$ and $\vec{c} = j + \lambda k$ are co-planar. **(05 Marks)**

### Module-2

3 a. If $y = \cos(m \log x)$ then prove that $x^2 y_{n+2} + (2n+1)x y_{n+1} + (m^2 + n^2) y_n = 0$. **(06 Marks)**

b. With usual notation prove that

$$\tan\phi = \frac{r d\theta}{dr}.$$ **(05 Marks)**

c. If $u = \log_e\left(\frac{x^4 + y^4}{x + y}\right)$, show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3$. **(05 Marks)**

**OR**

4 a. Find the Pedal equation of $r = a[1 - \cos\theta]$. **(06 Marks)**

b. Expand $\log_e(1+x)$ in ascending powers of x as far as the term containing $x^4$. **(05 Marks)**

c. Find the total derivative of $Z = xy^2 + x^2 y$, where $x = at^2$ $y = 2at$. **(05 Marks)**

### Module-3

5 a. Evaluate $\int_0^{\pi/6} \sin^6 3x\, dx$ using Reduction formula. **(06 Marks)**

b. Evaluate $\int_0^1 x^6\sqrt{1-x^2}\, dx$ – using Reduction formula. **(05 Marks)**

c. Evaluate $\int_1^2 \int_0^{2-y} xy\, dx\, dy$. **(05 Marks)**

**OR**



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6 a. Evaluate $\int_0^{\pi/2} \sin^3 x \cos^7 x \, dx$. **(06 Marks)**

b. Evaluate $\int_0^{\pi} x \cos^6 x \, dx$. **(05 Marks)**

c. Evaluate $\int_0^3 \int_0^2 \int_0^1 (x + y + z) \, dz \, dx \, dy$. **(05 Marks)**

## Module-4

7 a. A particle moves along the curve $\vec{r} = (1-t^3)\hat{i} + (1+t^2)\hat{j} + (2t - 5)\hat{k}$. Determine the velocity and acceleration. **(06 Marks)**

b. Find the directional derivative of $\phi = xy^2 + yz^3$ at the point (2,-1, 1) in the direction of the vector $i + 2j + 2k$. **(05 Marks)**

c. Find the constant a, b, c. Such that the vector $\vec{F} = (x + y + az)\,\hat{i} + (x + cy + 2z)\,\hat{k} + (bx + 2y - z)\,\hat{j}$ is irrotational. **(05 Marks)**

**OR**

8 a. Find the angle between the tangents to the curve $\vec{r} = t^2\,\hat{i} + 2t\,\hat{j} - t^3\,\hat{k}$ at the points $t = \pm 1$. **(06 Marks)**

b. Find the divergence and curl of the vector $\vec{F} = (xyz + y^2z)\,\hat{i} + (3x^2 + y^2z)\,\hat{j} + (xz^2 - y^2z)\,\hat{k}$. **(05 Marks)**

c. If $\vec{F} = (ax + 3y + 4z)\,\hat{i} + (x - 2y + 3z)\,\hat{j} + (3x + 2y - z)\,\hat{k}$ is solenoidal, find a. **(05 Marks)**

## Module-5

9 a. Solve $\frac{dy}{dx} = \frac{y}{x - \sqrt{xy}}$. **(06 Marks)**

b. Solve $\frac{dy}{dx} + y \cot x = \sin x$. **(05 Marks)**

c. Solve $\frac{dy}{dx} = \frac{x + 2y - 1}{x + 2y + 1}$. **(05 Marks)**

**OR**

10 a. Solve $(x^2 - y^2)\,dx = 2xy\,dy$. **(06 Marks)**

b. Solve $x\frac{dy}{dx} + y = x^3 y^6$. **(05 Marks)**

c. $(1 + xy)\,ydx + (1 - xy)\,xdy = 0$. **(05 Marks)**

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